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Designing Print and Online Documents

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Goals of Document Design

In designing a document, you have five major goals:

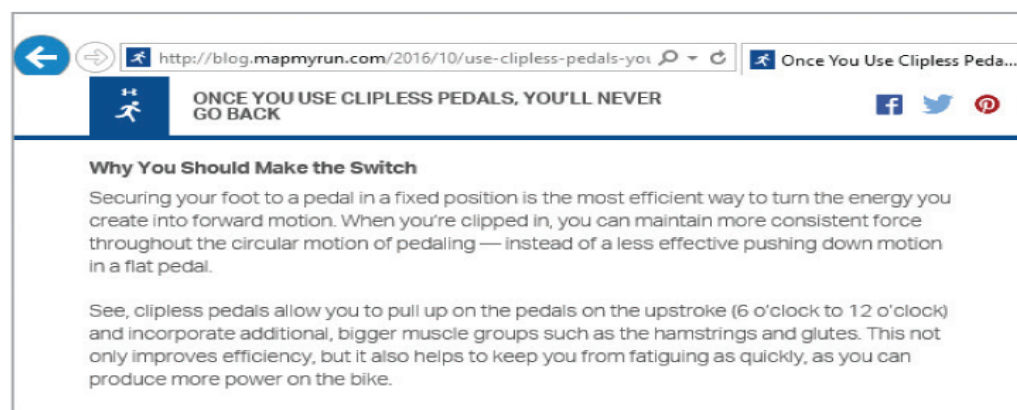
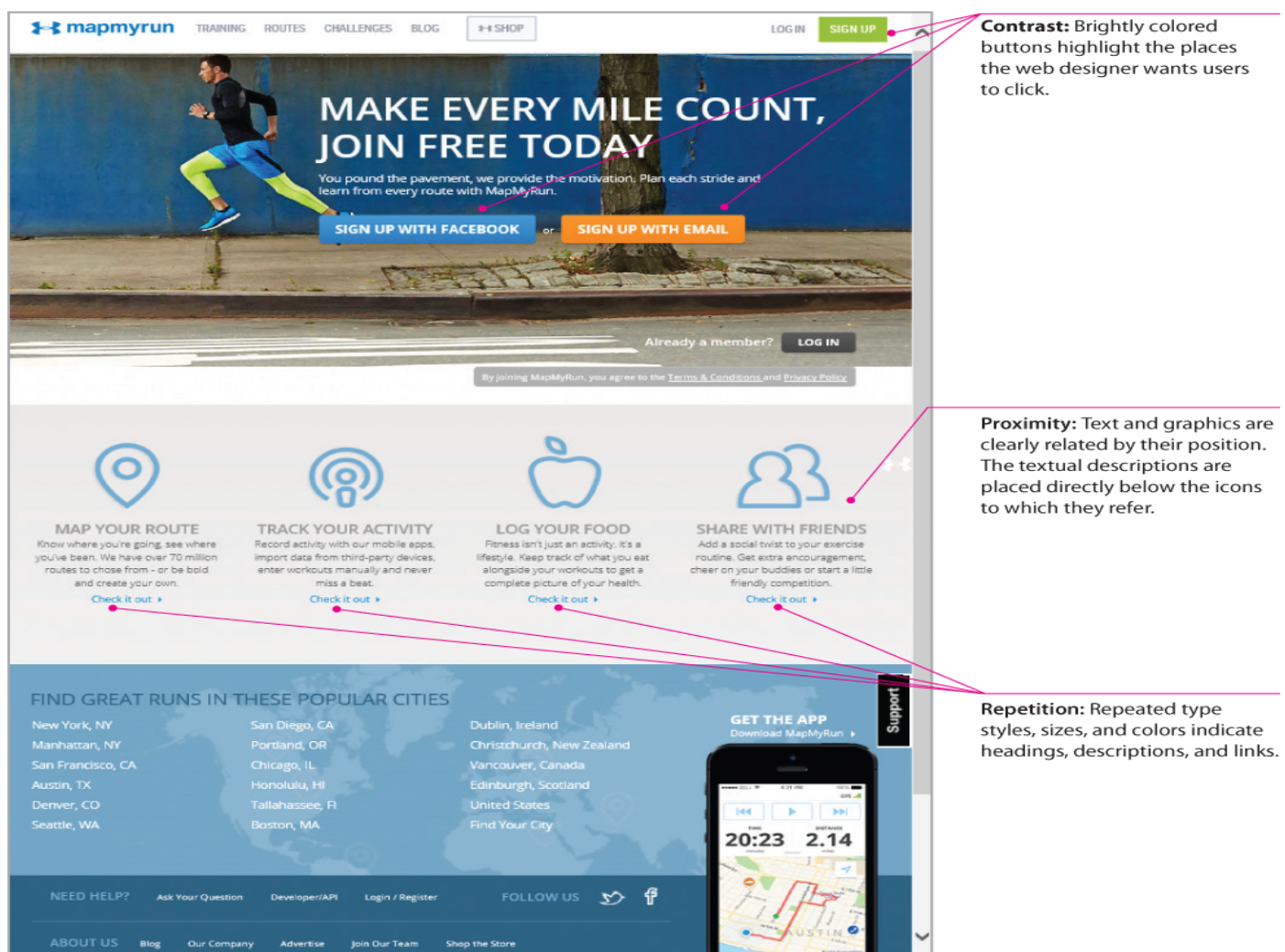
- **To make a good impression on readers.** Your document should reflect your own professional standards and those of your organization.
- **To help readers understand the structure and hierarchy of the information.** As they navigate a document, readers should know where they are and how to get where they are headed. They should also be able to see the hierarchical relationship between one piece of information and another.
- **To help readers locate and access the information they need.** Usually, people don't read every word in a print document, and they don't study every screen of an online document. In print documents, design elements (such as tabs, icons, and color), page design, and typography help readers find the information they need quickly and easily. In online documents, design elements are critically important because readers can see only what is displayed on the screen; without design elements to help them navigate, they are stranded.
- **To help readers understand the information.** Effective design can clarify information. For instance, designing a set of instructions so that the text describing each step is next to the accompanying graphic makes the instructions easier to understand. An online document with a navigation bar displaying the main sections is easier to understand than an online document without one.
- **To help readers remember the information.** An effective design helps readers create a visual image of the information, making it easier to remember. Text boxes, pull quotes, and similar design elements help readers remember important explanations and passages.

Understanding Design Principles

One of your biggest challenges in thinking about how to design a document is that, more than ever, readers control how the document appears. When they view documents online, through websites, apps, and other kinds of programs, readers can easily control many aspects of the design, including color and the size, shape, and location of objects on the screen. Perhaps the most significant variable that you have to consider is screen size. Some devices on which your readers will use your document will be as large as big-screen TVs, whereas others will be as small as wrist watches.

In this chapter, the term *print document* will be used to refer to documents that are designed to be printed on paper, such as letters, memos, and reports, regardless of whether readers hold pieces of paper in their hands or view the documents online. The term *online document* will be used to refer to documents that are designed to be used online, through websites, apps, and other software programs.

Because there are so many different types of print and online documents used in so many different environments by so many different people for so many different purposes, it is impossible to provide detailed advice about “how to design” a technical document. Still, there are some powerful and durable principles that can help you design any kind of print or online document. The following list is based on [Robin Williams’s *The Non-designer’s Design Book* \(2015\)](#), which describes four principles of design: proximity, alignment, repetition, and contrast. All of these principles are illustrated in [Figure 11.1](#) on pages 251–52.



Alignment: The writer uses two levels of headings, each reinforced by a different alignment.

On top of increased efficiency, a clipless pedal system is easier on the joints. When your cleat is lined up properly, your foot will be in the correct position over the pedal axle, which helps lessen strain on the knee joint. This makes it much easier to pedal at a higher cadence of around 90–100 revolutions per minute without losing contact with the pedal, and it also helps ease strain on the knee that comes from pedaling at lower rpms in larger gear ratios.

• The Different Types of Pedals and Cleats

In terms of which cleat-pedal system you need, there are three main options:

1. **Two-bolt cleats:** Used most often by mountain bikers, off-road cyclists and commuters (as well as spin class attendees), two-bolt cleats are much smaller and can be used with a shoe that's more flexible and easier to walk in. They're also commonly used with pedal systems that allow for dual-sided entry, which can be slightly easier for beginners. Shimano SPD and Crankbrothers are two major manufacturers.
2. **Three-bolt cleats:** This is the most common design for road cyclists. The cleat is fairly large and triangular in shape, and it screw into a stiff carbon or fiberglass sole on a dedicated road cycling shoe. Entry on most road cycling pedal designs is one-sided. Examples of major pedal manufacturers include Shimano SPD-SL, Look and Time.
3. **Four-bolt cleats:** As of right now, Speedplay is the only manufacturer using a four-bolt cleat design. Unlike the three-bolt design, Speedplay's offering has a locking mechanism on the cleat instead of the pedal. The rectangular cleat is placed over a smaller, circular pedal that allows more side-to-side float of the foot during the pedaling motion. This design also allows for dual-sided entry, which can make clipping in a bit easier. In terms of performance, the choice between this design and the generally more secure three-bolt design will likely come down to personal preference.

Keep in mind that cleats are usually only compatible with the type of pedal you choose. For instance, if you decide to buy Look Keo Classic pedals, you will also need the Look three-bolt cleats that work with that pedal. Likewise, Shimano three-bolt cleats will have a slightly different design and will work exclusively with Shimano pedals.

Figure 11.1

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Source: MapMyRun, 2017: <http://mapmyrun.com>.

Courtesy of MapMyRun.

FIGURE 11.1 Effective Use of Design Principles

- **Proximity.** The principle of proximity is simple: if two items appear close to each other, the reader will interpret them as related to each other. If they are far apart, the reader will interpret them as unrelated. Text describing a graphic should be positioned close to the graphic.
- **Alignment.** The principle of alignment says that you should consciously line up text and graphics along a real or imaginary vertical axis so that the reader can understand the relationships among elements.
- **Repetition.** The principle of repetition says that you should format the same kind of information in the same way so that readers can recognize consistent patterns. For example, all first-level headings should have the same typeface, type size, spacing above and below, and so forth. This repetition signals a connection between headings, making the content easier to understand. Other elements that are used to create consistent visual patterns are colors, icons, rules (straight lines), and screens (shaded backgrounds).



To watch a tutorial on proofreading, see the additional resources in LaunchPad.

- **Contrast.** The principle of contrast says that the human eye is drawn to — and the brain interprets — differences in appearance between two items. For example, the principle of contrast explains why black print is easier to read against a white background than against a dark gray background; why 16-point type stands out more clearly against 8-point type than against 12-point type; and why information printed in a color, such as red, grabs readers' attention when the information around it is printed in black.

Planning Your Design

In a typical day at work, you might produce a number of documents without having to worry about design at all. Blog posts, text messages, presentation slides, and memos that use standard company templates — these applications and others present no design challenges either because you *cannot* design them or because you don't have the *authority* to design them.

You will, however, have a say in the design of many documents you produce or to which you contribute. In such a case, the first step in designing the document is to plan. Analyze your audience and purpose, and then determine your resources.

ANALYZE YOUR AUDIENCE AND PURPOSE

Consider factors such as your readers' knowledge of the subject, their attitudes, their reasons for reading, the way they will be using the document, and the kinds of tasks they will perform. For instance, if you are writing a benefits manual for employees, you know that few people will read it from start to finish but that many people will refer to it. Therefore, you should include navigational tools: a table of contents, an index, tabs, and so forth.

Think too about your audience's expectations. Readers expect to see certain kinds of information presented in certain ways. Try to fulfill those expectations. For example, hyperlinks on websites are often underscored and presented in blue type.

If you are writing for multicultural readers, keep in mind that many aspects of design vary from one culture to another. In memos, letters, reports, and manuals, you may see significant differences in design practice. The best advice, therefore, is to study documents from the culture you are addressing. Here are a few design elements to look for:

- **Paper size.** Paper size will dictate some aspects of your page design. If your document will be printed in another country, find out about standard paper sizes in that country.
- **Typeface preferences.** One survey found that readers in the Pacific Rim prefer sans-serif typefaces in body text, whereas Western readers prefer serif typefaces ([Ichimura, 2001](#)).

Typography is discussed on [pp. 263–69](#).

- **Color preferences.** In China, for example, red suggests happiness, whereas in Japan it suggests danger.
- **Text direction.** If some members of your audience read from right to left but others read from left to right, you might arrange your graphics vertically, from top to bottom; everybody reads from top to bottom. Or you might use Arabic numerals to indicate the order in which items are to be read ([Horton, 1993](#)).

For more about analyzing your audience, see [Ch. 5](#). For more about tables of contents, see [Ch. 18, p. 482](#).

Another important consideration is accessibility. Up to one-fifth of your online audience may have visual, hearing, mobility, or cognitive impairments that could make it difficult for them to use your online document ([WebAIM, 2016](#)). For more details about legal and ethical recommendations for designing accessible websites, see [pages 281–84](#).

Think, too, about your purpose or purposes. For example, imagine that you are opening a dental office and you want to create a website. The first question is *What is the purpose of the site?* It's one thing to provide information on your hours and directions to the office. But do you also want to direct patients to high-quality dental information? To enable them to set up or change appointments or ask you a question? Each of these purposes affects the design, whether the document is going to be printed or online.

For more about analyzing your purpose, see [Ch. 5, p. 86](#).

DETERMINE YOUR RESOURCES

Think about your resources of time, money, and equipment. Short, informal documents are usually produced in-house; more ambitious projects are often subcontracted to specialists. If your organization has a technical-publications department, consult the people there about scheduling and budgeting.

- **Time.** What is your schedule? To come up with a sophisticated design you might need professionals at service bureaus or print shops or specialists in online production. These professionals can require weeks or months.
- **Money.** Can you afford professional designers, print shops, and online-content developers? Most managers would budget thousands of dollars to design an annual report but not an in-house newsletter.
- **Equipment.** Complex designs require graphics and web software, as well as layout programs. A basic

laser printer can produce attractive documents in black and white, but you need a more expensive printer for high-resolution color.

For information on designing online documents, see [pp. 274](#) and [284](#).

Designing Print Documents

Before you design the individual pages of a printed document, design the overall document. Decide whether to use paper of standard size (8.5 × 11 inches) or another size, choose a grade of paper, and decide how you will bind the pages together. Decide on the navigational elements you will include, such as a table of contents, index, and tabs. You want the different elements to work together to accomplish your objectives, and you want to stay within your budget for producing and (perhaps) shipping. That is, in designing the whole document, consider these four elements: size, paper, bindings, and navigational aids.

SIZE

Size refers to two aspects of print-document design: page size and page count.

- **Page size.** Think about the best page size for your information and about how the document will be used. For a procedures manual that will sit on a shelf most of the time, three-hole 8.5 × 11-inch paper is a good choice. For a software tutorial that must fit easily on a desk while the reader works at the keyboard, consider a 5.5 × 8.5-inch size. Paper comes precut in a number of sizes, including 4.5 × 6 inches and 6 × 9 inches. Although paper can be cut to any size, nonstandard sizes are more expensive.
- **Page count.** Because paper is expensive and heavy, you want as few pages as possible, especially if you are printing and mailing many copies. And there is a psychological factor, too: people don't want to spend a lot of time reading technical documents. Therefore, if you can design a document so that it is 15 pages long rather than 30 — but still attractive and easy to read — your readers will appreciate it.

PAPER

Paper is made not only in different standard sizes but also in different weights and with different coatings. Heavier paper costs more than lighter paper but provides better resolution for text and graphics. Coated paper is stronger and more durable than non-coated paper and provides the best resolution, but some coatings can produce a glare. To deal with this problem, designers often choose paper with a slight tint.

Work closely with printing professionals. They know, for example, about UV-coated paper, which greatly reduces fading, and about recycled paper, which is continually improving in quality and decreasing in price.

BINDINGS

Although the pages of a very short document can be attached with a paper clip or a staple, longer documents require more sophisticated binding techniques. [Table 11.1](#) illustrates and describes the four types of bindings commonly used in technical communication.

TABLE 11.1 Common Types of Binding



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Loose-leaf binders. Loose-leaf binders are convenient when pages must be added and removed frequently. A high-quality binder can cost as much as several dollars.

Ring or spiral binders. The wire or plastic coils or combs that hold the pages together enable you to open the document flat on a desk or even fold it over so that it takes up the space of only one page. Print shops can bind documents of almost any size in plastic coils or combs.

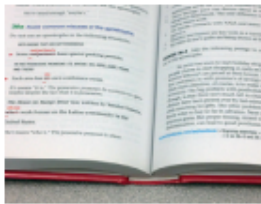


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Saddle binding. The document is opened to its middle pages, and large staples are inserted from the outside. Saddle binding is impractical for large documents.



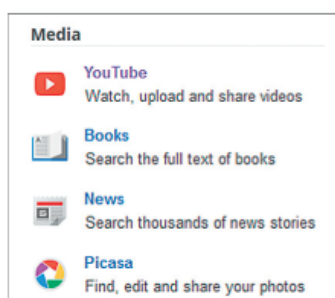
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Perfect binding. Pages are glued together along the spine edge, and a cover is attached. Perfect binding, used in book publishing, produces the most formal appearance, but it is relatively fragile, and the open document usually does not lie flat.

NAVIGATIONAL AIDS

In a well-designed document, readers can easily find the information they seek. Most navigational aids use the design principles of repetition and contrast to help readers navigate the document. [Table 11.2](#) explains six common kinds of navigational aids.

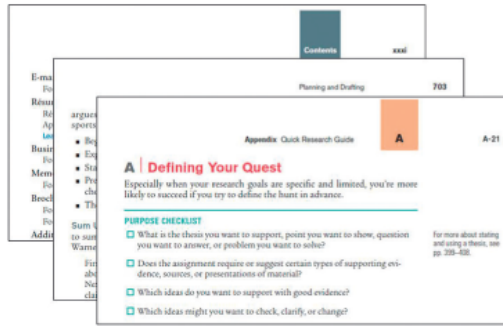
TABLE 11.2 Typical Navigational Aids



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Communication*, 12e, © 2018
Bedford/St. Martin's

Icons. Icons are pictures that symbolize actions or ideas. Perhaps the most important icon is the stop sign, which alerts you to a warning. Icons depend on repetition: every time you see the warning icon, you know what kind of information the writer is presenting.

Don't be too clever in thinking up icons. One computer manual uses a cocktail glass about to fall over to symbolize "tip." This is a bad idea, because the pun is not functional: when you think of a cocktail glass, you don't think of a tip for using computers. Don't use too many different icons, or your readers will forget what each one represents.



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matter and Arabic numerals for the body. There is no number on the title page, but the page following it is ii.

Appendixes are often paginated with a letter and number combination: Appendix A begins with page A-1, followed by A-2, and so on; Appendix B starts with page B-1.

Sometimes documents list the total number of pages in the document (so recipients can be sure they have all of them). The second page is "2 of 17," and the third page is "3 of 17."

Documents that will be updated are sometimes numbered by section: Section 3 begins with page 3-1, followed by 3-2; Section 4 begins with 4-1. This way, a complete revision of one section does not affect the page numbering of subsequent sections.

TECH TIP

Why To Set Up Pages

An important key to meeting your audience's needs and expectations is effective page layout. Micro-soft Word and other programs provide default page-layout settings, which you can easily adjust for any document you create in order to meet the needs of your audience and accomplish your purpose.

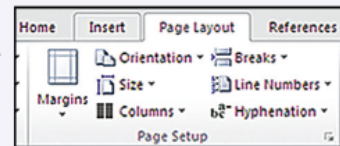
How To Set Up Pages

In the **Page Setup** group, use the **Page Setup** dialog box launcher to display the **Page Setup** dialog box.



Use the **Margins**, **Paper**, and **Layout** tabs to specify such design elements as page margins, paper orientation, paper size, starting locations for new sections, and header and footer placement.

You can also use the drop-down menus on the **Page Setup** group to control many of the same design elements.



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Designing Print Pages

In a well-designed printed page of technical communication, the reader can recognize patterns, such as where to look for certain kinds of information.

PAGE LAYOUT

Every page has two kinds of space: white space and space devoted to text and graphics. The best way to design a page is to make a grid: a drawing of what the page will look like. In making a grid, you decide how to use white space and determine how many columns to have on the page.

GUIDELINES: Understanding Learning Theory and Page Design

In designing the page, create visual patterns that help readers find, understand, and remember information. Three principles of learning theory, the result of research into how people learn, can help you design effective pages: chunking, queuing, and filtering.

- ▶ **Chunking.** People understand information best if it is delivered to them in chunks — small units — rather than all at once. For single-spaced type, chunking involves double-spacing between paragraphs, as shown in [Figure 11.2](#).
- ▶ **Queuing.** Queuing refers to creating visual distinctions to indicate levels of importance. More emphatic elements — those with bigger type or boldface type — are more important than less emphatic ones. Another visual element of queuing is alignment. Designers start more important information closer to the left margin and indent less important information. (An exception is titles, which are often centered in reports in the United States.) [Figure 11.3](#) shows queuing.
- ▶ **Filtering.** Filtering is the use of visual patterns to distinguish various types of information. Introductory material might be displayed in larger type, and notes might appear in italics, another typeface, and a smaller size. [Figure 11.4](#) shows filtering.

An unmanned aircraft system (UAS), sometimes called a drone, is an aircraft without a human pilot onboard—instead, the UAS is controlled from an operator on the ground. When you fly a drone in the United States, it is your responsibility to understand and abide by the rules. Recreational or hobby UAS use is defined as flying for enjoyment and not for work, business purposes, or for compensation or hire. There are two ways for recreational or hobby UAS fliers to operate in the National Airspace System in accordance with the law and/or FAA regulations. Each of the two options has specific requirements that the UAS operator must follow. The decision as to which option to follow is up to the individual operator. The first option is to fly in accordance with the Special Rule for Model Aircraft (Public Law 112-95 Section 336). Under this rule, operators must fly for hobby or recreational purposes only; follow a community-based set of safety guidelines; fly the UAS within visual line-of-sight; give way to manned aircraft; provide prior notification to the airport and air traffic control tower, if one is present, when flying within 5 miles of an airport; fly UAS that weigh no more than 55 lb unless certified by a community-based organization; and register the aircraft (UAS over 0.55 lb and less than 55 lb can be registered online at registermyuas.faa.gov; UAS 55 lb or greater must be registered through the FAA's paper-based process). The second option is to fly in accordance with the FAA's Small UAS Rule (Part 107). This requires operators to obtain a remote pilot certificate or be under the direct supervision of someone who holds such a certificate; register the aircraft as a non-modeler at registermyuas.faa.gov; and follow all the operating rules in accordance with the regulation.	An unmanned aircraft system (UAS), sometimes called a drone, is an aircraft without a human pilot onboard—instead, the UAS is controlled from an operator on the ground. When you fly a drone in the United States, it is your responsibility to understand and abide by the rules. Recreational Use of Unmanned Aircraft Systems Recreational or hobby UAS use is defined as flying for enjoyment and not for work, business purposes, or for compensation or hire. There are two ways for recreational or hobby UAS fliers to operate in the National Airspace System in accordance with the law and FAA regulations. Each of the two options has specific requirements that the UAS operator must follow. The decision as to which option to follow is up to the individual operator. Option 1 The first option is to fly in accordance with the Special Rule for Model Aircraft (Public Law 112-95 Section 336). Under this rule, operators must do all of the following: • Fly for hobby or recreational purposes only. • Follow a community-based set of safety guidelines. • Fly the UAS within visual line-of-sight. • Give way to manned aircraft. • Provide prior notification to the airport and air traffic control tower, if one is present, when flying within 5 miles of an airport. • Fly UAS that weigh no more than 55 lb unless certified by a community-based organization. • Register the aircraft with the FAA. Option 2 The second option is to fly in accordance with the FAA's Small UAS Rule (Part 107). This requires operators to obtain a remote pilot certificate or be under the direct supervision of someone who holds such a certificate; register the aircraft as a non-modeler at registermyuas.faa.gov; and follow all the operating rules in accordance with the regulation.
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a. Without chunking

b. With chunking

Figure 11.2

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

Text adapted from Federal Aviation Administration, 2016: www.faa.gov/uas/faqs/#ffr.

FIGURE 11.2 **Chunking**

Chunking emphasizes units of related information. Note how the use of headings and lists creates clear chunks of information.

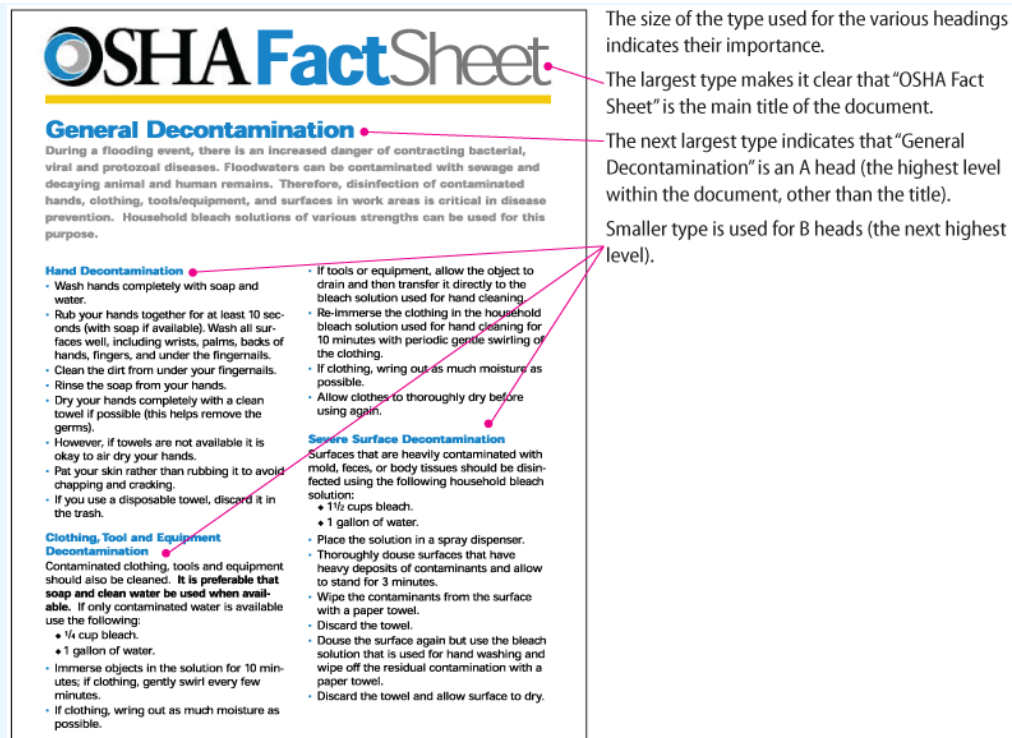


Figure 11.3
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Department of Labor, 2005: https://www.osha.gov/OshDoc/data_Hurricane_Facts/general_decontamination_fact.pdf.

FIGURE 11.3 Queuing

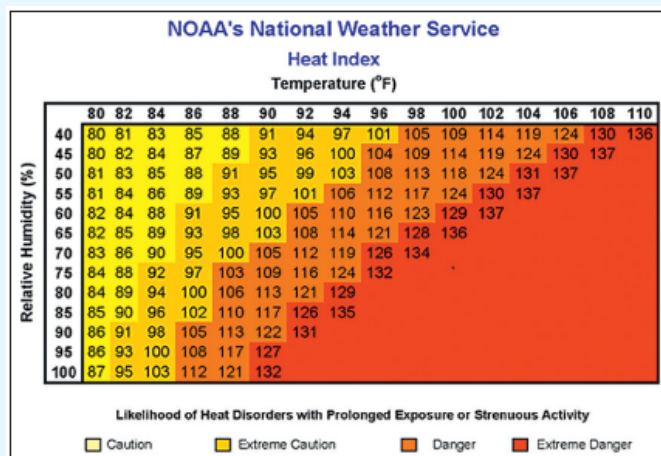


Figure 11.4
Markel/Selber, *Technical Communication*, 12e,
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Information from National Weather Service, 2014:
<http://nws.noaa.gov/os/heat/index.shtml>.

FIGURE 11.4 Filtering

Effective technical communication presents data and explains what the data mean. In this table about the heat index, the writer uses color as a filtering device. In Western cultures, red signals danger.

Page Grids As the phrase suggests, a *page grid* is like a map on which you plan where the text, the graphics, and the white space will go. Many writers like to begin with a *thumbnail sketch*, a rough drawing that shows how the text and graphics will look on the page. [Figure 11.5](#) shows thumbnail sketches of several options for a page from the body of a manual.

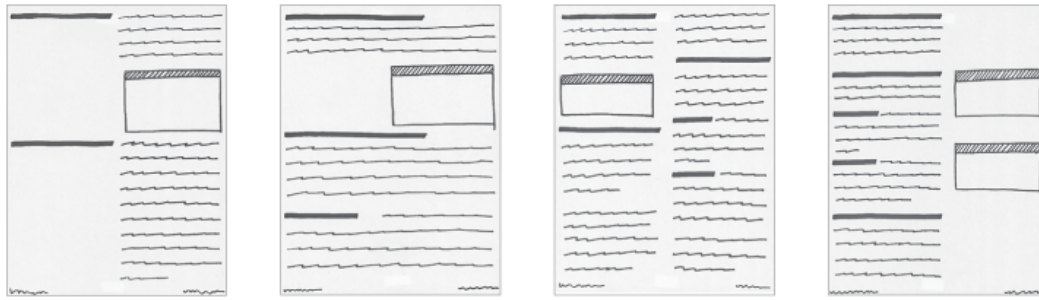


Figure 11.5
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.5 Thumbnail Sketches

Experiment by sketching the different kinds of pages of your document: body pages, front matter, and so on. When you are satisfied, make page grids. You can use either a computer or a pencil and paper, or you can combine the two techniques.

[Figure 11.6](#) shows two simple grids: one using *picas* (the unit that printing professionals use, which equals one-sixth of an inch) and one using inches.

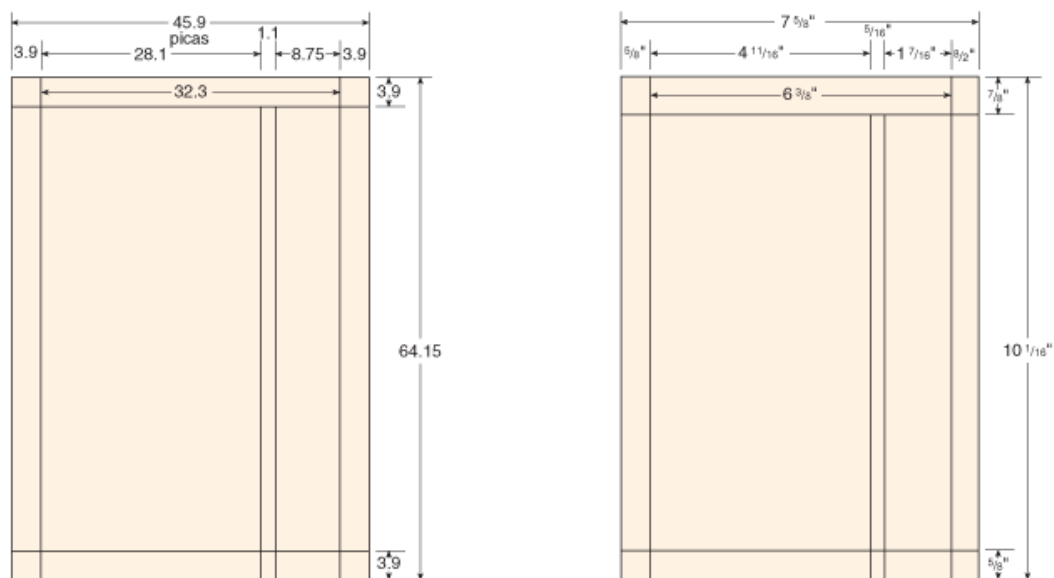


Figure 11.6
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.6 Sample Grids Using Picas and Inches

White Space Sometimes called *negative space*, white space is the area of the paper with no writing or graphics: the space between two columns of text, the space between text and graphics, and, most obviously, the margins.

Margins, which make up close to half the area on a typical page, serve four main purposes:

- They reduce the amount of information on the page, making the document easier to read and use.
- They provide space for binding and allow readers to hold the page without covering up the text.
- They provide a neat frame around the type.
- They provide space for marginal glosses.

[Figure 11.7](#) shows common margin widths for an 8.5 × 11-inch document.

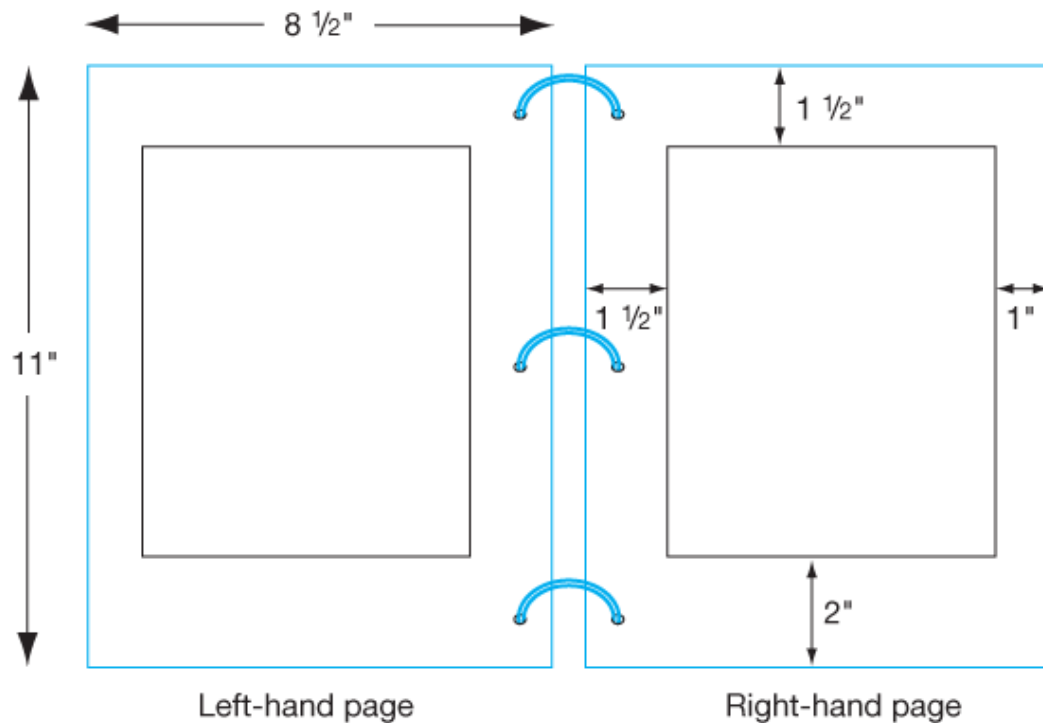


Figure 11.7
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.7 Typical Margins for a Document That Is Bound Like a Book

Increase the size of the margins if the subject is difficult or if your readers are not knowledgeable about it.

White space can also set off and emphasize an element on the page. For instance, white space around a graphic separates it from the text and draws readers' eyes to it. White space between columns helps readers read the text easily. And white space between sections of text helps readers see that one section is ending and another is beginning.

Columns Many workplace documents have multiple columns. A multi-column design offers three major advantages:

- Text is easier to read because the lines are shorter.
- Columns allow you to fit more information on the page, because many graphics can fit in one column or extend across two or more columns. In addition, a multicolumn design enables you to put more words on a page than a single-column design.
- Columns enable you to use the principle of repetition to create a visual pattern, such as text in one column and accompanying graphics in an adjacent column.

[Figure 11.8](#) on page 264 shows a two-column design with graphics. [Figure 11.9](#) on page 265 shows a single-column design with graphics and marginal text boxes.

A multicolumn design enables you to present a lot of text and graphics of different sizes.

Notice how the designer has used the whole width of the page for one graphic and a single column for a smaller graphic.

Note that the alley—the space between the two columns of text—need not be wide. Nor do you need to include a vertical rule to keep the columns separate. The human brain easily understands that each column is a separate space.

In this sample, the bar graph is exactly the width of the column in which it appears. But it doesn't have to be. It could break the shape of the column and extend into the other column or even into the margin. Or it could be narrower than its column, with the text wrapping around it. The design you see here looks neat and professional. If the graph were wider or narrower than the column, the design might appear somewhat more creative.



Figure 11.8
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Patent and Trademark Office, 2013: <http://www.uspto.gov/about/stratplan/ar/USPTOFY2012PAR.pdf>.

FIGURE 11.8 A Multicolumn Design



PDF Page Content

Page Description Language

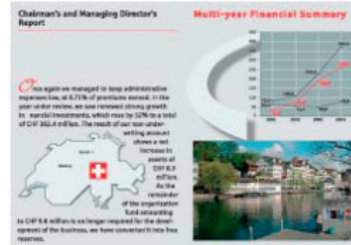
PDF is a page description language, i.e. it describes how a page looks so that it can be reproduced for viewing and printing. The language resembles Postscript, but is much simpler to allow for more efficient processing. For example, it does not contain control structures like loops and „if“ statements.

PDF Page Content Elements

Basically PDF recognizes three types of page content elements:

- Text (font programs)
- Graphic paths (lines and curves)
- Images (raster samples)

The picture to the right shows examples of the three PDF content types.



Content Objects

PDF uses objects and object types to describe the content. Every string of text and all graphics and images are defined by one or several objects, created from one or more object types.

- Text Objects. Text objects are defined by a number of attributes including font family, style and size, a string of characters, and a position on a page. PDF does not recognize nor store objects for line breaks, headers, paragraphs, indentation etc. (i.e. paragraph formatting operators used in word processing applications like Microsoft Word). Text is broken down into fragments as small as single characters but not more than one line. The fragments can be randomly stored and are like pieces of a puzzle that all have to be placed in their correct location on the page to complete its appearance.
- Graphic Path Objects. A graphic path object is an arbitrary shape made up of straight lines, rectangles, and cubic Bézier curves. A graphic path object ends with one or more painting operators that specify whether the path is stroked, filled, used as a clipping boundary or some combination of these operations.
- PDF Image Objects. A PDF-specific image format is used for embedding images in a PDF file. This format is independent of the input image format. For example, scanned pages in TIFF format or GIF images that are converted to PDF are newly packaged into PDF image format. Once an image has been converted to PDF image format, it is usually not possible to determine what the original image format was. It is however possible to export PDF images into raster image formats, provided the raster image format supports all features of the image (e.g. transparency).

Unlike word processors, text is not continuous in a paragraph.

Text is defined in fragments with attributes such as font and font size, a string of characters and a location on a page.

Images that are imported into a PDF file are converted to PDF image format. They are not stored as TIFF, GIF etc. images.

This page from a software company's white paper — a marketing document usually distributed on the web — shows one approach to a one-column design.

The main text column is relatively narrow, making the lines easy to read.

The right margin is wide enough to accommodate text boxes, small graphics, or other items.

One goal of document design is to reduce the number of pages needed — but when you design a page, you want to make the text inviting and easy to read. Figuring out how to balance these two priorities is one of the major challenges of designing a page.

Figure 11.9
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Courtesy of PDF Tools AG.

FIGURE 11.9 A One-Column Design

TECH TIP

Why To Format Columns

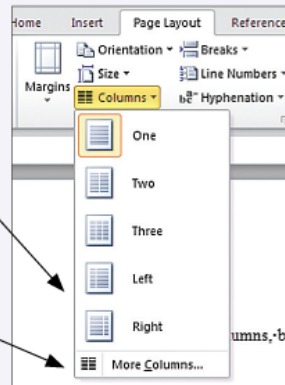
A multicolumn format allows you to fit more text on the page, create easier-to-read and more visually interesting pages, and have more options when sizing and placing graphics.

How To Format Columns

To divide your document into multiple columns, select the **Page Layout** tab in Word to access the **Page Setup** group.

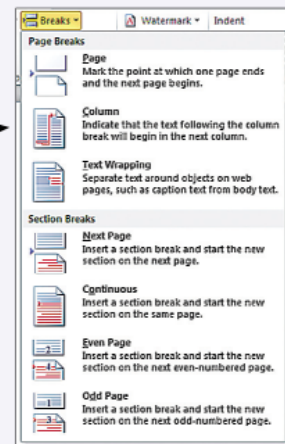
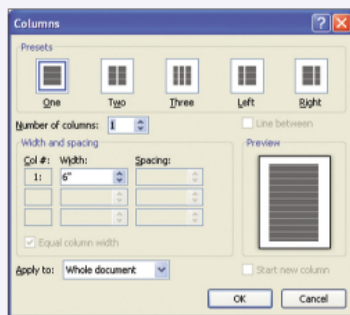
In the **Page Setup** group, select **Columns** and use the **Columns** drop-down menu to view preset layouts.

You can also select **More Columns** to launch the **Columns** dialog box. You can control the **number of columns** and specify the **width** and **spacing** yourself.



When you divide your document into columns, text flows from the bottom of one column to the top of the next column. Columns enable you to use the principle of repetition to create a visual pattern, such as text in one column and accompanying graphics in an adjacent column.

If you want to end a column of text in a specific location or create columns of equal length, use the **Breaks** drop-down menu to insert a **column break**. This action will move the text following the break to the next column.



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TYPOGRAPHY

Typography, the study of type and the way people read it, encompasses typefaces, type families, case, and type size, as well as factors that affect the white space of a document: line length, line spacing, and justification.

Typefaces A typeface is a set of letters, numbers, punctuation marks, and other symbols, all bearing a characteristic design. There are thousands of typefaces, and more are designed every year. [Figure 11.10](#) on page 266 shows three contrasting typefaces.

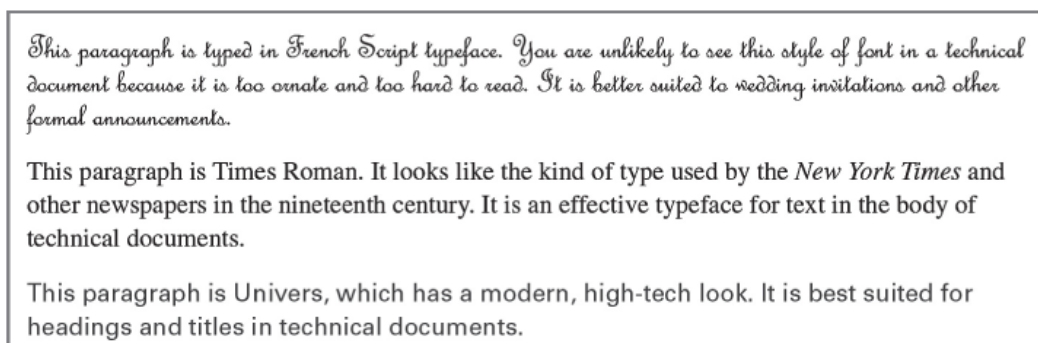


Figure 11.10

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FIGURE 11.10 Three Contrasting Typefaces

As [Figure 11.11](#) illustrates, typefaces are generally classified into two categories: *serif* and *sans serif*.

Although scholars used to think that serif typefaces were easier to read because the serifs encourage readers' eyes to move along the line, most now believe that there is no difference in readability between serif and sans-serif typefaces, either in print or online. Readers are most comfortable with the style they see most often.

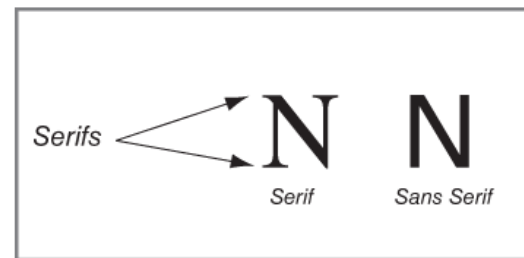


Figure 11.11
Markel/Selber, *Technical Communication*, 12e,
© 2018 Bedford/St. Martin's

FIGURE 11.11 Serif and Sans-Serif Typefaces

Most of the time you will use a handful of standard typefaces such as Times New Roman, Cambria, Calibri, and Arial, which are included in your word-processing software and which your printer can reproduce.

Type Families Each typeface belongs to a family of typefaces, which consists of variations on the basic style, such as italic and boldface. [Figure 11.12](#), for example, shows the Helvetica family.

Helvetica Light	<i>Helvetica Bold Italic</i>
<i>Helvetica Light Italic</i>	Helvetica Heavy
Helvetica Regular	<i>Helvetica Heavy Italic</i>
<i>Helvetica Regular Italic</i>	Helvetica Regular Condensed
Helvetica Bold	<i>Helvetica Regular Condensed Italic</i>

Figure 11.12
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.12 Helvetica Family of Type

Be careful not to overload your document with too many different members of the same family. Used sparingly and consistently, these variations can help you with filtering: calling attention to various kinds of text, such as warnings and notes. Use italics for book titles and other elements, and use bold type for emphasis and headings. Stay away from outlined and shadowed variations. You can live a full, rewarding life without ever using them.

Case To make your document easy to read, use uppercase and lowercase letters as you would in any other kind of writing (see [Figure 11.13](#)). Most people require 10 to 25 percent more time to read text using all uppercase letters than to read text using both uppercase and lowercase. In addition, uppercase letters take up as much as 35 percent more space than lowercase letters ([Haley, 1991](#)). If the text includes both cases, readers will find it easier to see where new sentences begin ([Poulton, 1968](#)).

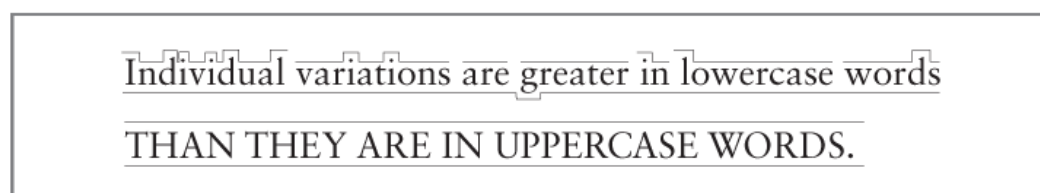


Figure 11.13
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.13 Individual Variations in Lowercase and Uppercase Type

Lowercase letters are easier to read than uppercase because the individual variations from one letter to another are greater.

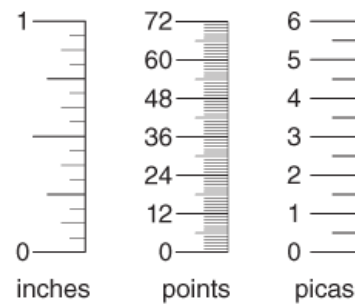
Type Size Type size is measured with a unit called a *point*. There are 12 points in a pica and 72 points in an

inch. In most technical documents 10-, 11-, or 12-point type is used for the body of the text:

This paragraph is printed in 10-point type. This size is easy to read, provided it is reproduced on a high-quality ink-jet printer or laser printer.

This paragraph is printed in 12-point type. If the document will be read by people over age 40, 12-point type is a good size because it is more legible than a smaller size.

This paragraph is printed in 14-point type. This size is appropriate for headings.



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Type sizes used for other parts of a document include the following:

- | | |
|--------------------------|---------------------------------|
| footnotes | 8- or 9-point type |
| indexes | 2 points smaller than body text |
| slides or transparencies | 24- to 36-point type |

In general, aim for at least a 2- to 4-point difference between the headings and the body. Too many size variations, however, suggest a sweepstakes advertisement rather than a serious text.

ETHICS NOTE

USING TYPE SIZES RESPONSIBLY

Text set in large type contrasts with text set in small type. It makes sense to use large type to emphasize headings and other important information. But be careful with small type. It is unethical (and, according to some court rulings, illegal) to use excessively small type (such as 6-point or smaller type) to disguise information that you *don't* want to stand out. When you read the fine print in an ad for cell-phone service, you get annoyed if you discover that the low rates are guaranteed for only three months or that you are committing to a long-term contract. You *should* get annoyed. Hiding information in tiny type is annoying. Don't do it.

Line Length The line length most often used on an 8.5 × 11-inch page — about 80 characters — is somewhat difficult to read. A shorter line of 50 to 60 characters is easier, especially in a long document ([Biggs, 1980](#)).

Line Spacing Sometimes called *leading* (pronounced “ledding”), *line spacing* refers to the amount of white space between lines or between a line of text and a graphic. If lines are too far apart, the page looks diffuse, the text loses coherence, and readers tire quickly. If lines are too close together, the page looks crowded and becomes difficult to read. Some research suggests that documents that have small type, long lines, and/or sans-serif typefaces benefit from extra line spacing. [Figure 11.14](#) shows three variations in line spacing.

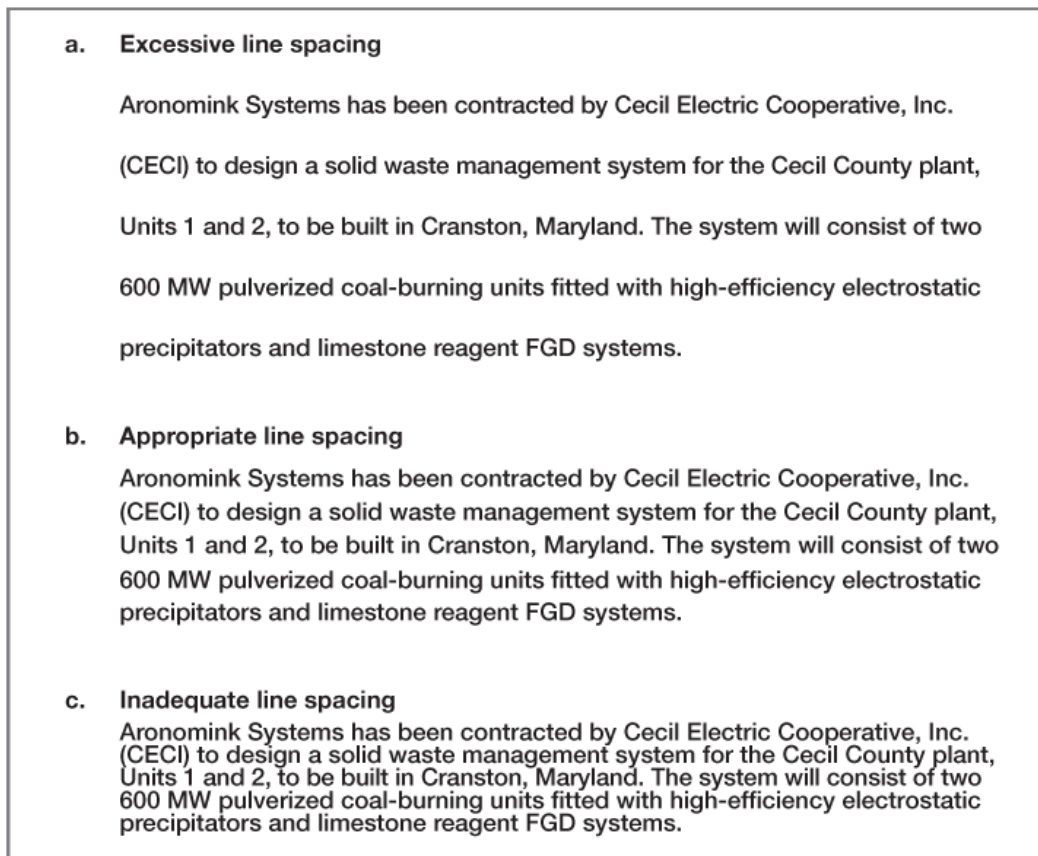


Figure 11.14
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.14 Line Spacing

Line spacing is usually determined by the kind of document you are writing. Memos and letters are single-spaced; reports, proposals, and similar documents are often double-spaced or one-and-a-half-spaced. [Figure 11.15](#) on page 270 shows how line spacing can be used to distinguish one section of text from another and to separate text from graphics.

The line spacing between two sections is greater than the line spacing within a section.

Line spacing is also used to separate the text from the graphics.

Net (Cost)/Income (Dollars in Millions)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Earned Revenue	\$ 1,372.8	\$ 1,594.4	\$ 1,735.7	\$ 1,862.2	\$ 1,927.1
Program Cost	(1,424.0)	(1,514.2)	(1,769.6)	(1,892.6)	(1,981.9)
Net (Cost)/Income	\$ (51.2)	\$ 80.2	\$ (33.9)	\$ (30.4)	\$ (54.8)

STATEMENT OF NET COST

The Statement of Net Cost presents the USPTO's results of operations by the following responsibility segments – Patent, Trademark, and Intellectual Property Protection and Enforcement Domestically and Abroad. The above table presents the total USPTO's results of operations for the past five fiscal years. In FY 2005, the USPTO's operations resulted in a net cost. In FY 2006, the USPTO generated a net income due to the increased maintenance fees received and revenue recognition of previously deferred revenue collected subsequent to the fee increase on December 8, 2004. During FY 2007, FY 2008, and FY 2009 the USPTO's operations resulted in a net cost of \$33.9 million, \$30.4 million, and \$54.8 million, respectively.

The Statement of Net Cost compares fees earned to costs incurred during a specific period of time. It is not necessarily an indicator of net income or net cost over the life of a patent or trademark. Net income or net cost for the fiscal year is dependent upon work that has been completed over the various phases of the production life cycle. The net income calculation is based on fees earned during the fiscal year being reported, regardless of when those fees were collected. Maintenance fees also play a large part in whether a total net income or net cost is recognized. Maintenance fees collected in FY 2009 are a reflection of patent issue levels 3.5, 7.5, and 11.5 years ago, rather than a reflection of patents issued in FY 2009. Therefore, maintenance fees can have a significant impact on matching costs and revenue.

During FY 2009, with the number of patent filings decreasing by 2.3 percent over the prior year, the backlog for patent applications likewise decreased, decreasing deferred revenue and increasing earned revenue. This was evidenced by the Patent organization disposing of 22.9 percent more applications than were disposed of during FY 2008.

During FY 2009, with the number of trademark applications decreasing by 12.3 percent over the prior year, the Trademark organization was able to continue to address the existing inventory and reduce pendency by 0.3 months from FY 2008. The Trademark organization was able to do this while recognizing a slight decrease in revenue earned.

EARNED REVENUE

The USPTO's earned revenue is derived from the fees collected for patent and trademark products and services. Fee collections are recognized as earned revenue when the activities to complete the work associated with the fee are completed. The table below presents the earned revenue for the past five years.

Earned revenue totaled \$1,927.1 million for FY 2009, an increase of \$64.9 million, or 3.5 percent, over FY 2008 earned revenue of \$1,862.2 million. Of revenue earned during FY 2009, \$454.3 million related to fee collections that were deferred for revenue recognition in prior fiscal years, \$546.7 million related to maintenance fees collected during FY 2009, which were considered earned immediately, \$920.7 million related to work performed for fees collected during FY 2009, and \$5.4 million were not fee-related.

Earned Revenue (Dollars in Millions)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Patent	\$ 1,197.8	\$ 1,384.2	\$ 1,507.0	\$ 1,625.0	\$ 1,697.4
Percentage Change in Patent Earned Revenue	9.6%	15.6%	8.9%	7.8%	4.5%
Trademark	175.0	210.2	228.7	237.2	229.7
Percentage Change in Trademark Earned Revenue	19.5%	20.1%	8.8%	3.7%	(3.2)%
Total Earned Revenue	\$ 1,372.8	\$ 1,594.4	\$ 1,735.7	\$ 1,862.2	\$ 1,927.1
Percentage Change in Earned Revenue	10.8%	16.1%	8.9%	7.3%	3.5%

48 PERFORMANCE AND ACCOUNTABILITY REPORT: FISCAL YEAR 2009

Figure 11.15
 Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
 Information from U.S. Patent and Trademark Office, 2010: www.uspto.gov/about/stratplan/ar/2009/2009annualreport.pdf.

FIGURE 11.15 Line Spacing Used To Distinguish One Section from Another

Justification Justification refers to the alignment of words along the left and right margins. In technical communication, text is often *left-justified* (also called *ragged right*). Except for the first line in each paragraph, which is sometimes indented, the lines begin along a uniform left margin but end on an irregular right margin. Ragged right is most common in word-processed text (even though word processors can justify the right margin).

In *justified* text, also called *full-justified text*, both the left and the right margin are justified. Justified text is seen most often in formal documents, such as books. The following passage ([U.S. Department of Agriculture, 2002](#)) is presented first in left-justified form and then in justified form:

We recruited participants to reflect the racial diversity of the area in which the focus groups were conducted. Participants had to meet the following eligibility criteria: have primary responsibility or share responsibility for cooking in their household; prepare food and cook in the home at least three times a week; eat meat and/or poultry; prepare meat and/or poultry in the home at least twice a week; and not regularly use a digital food thermometer when cooking at home.

We recruited participants to reflect the racial diversity of the area in which the focus groups were conducted. Participants had to meet the following eligibility criteria: have primary responsibility or share responsibility for cooking in their household; prepare food and cook in the home at least three times a week; eat meat and/or poultry; prepare meat and/or poultry in the home at least twice a week; and not regularly use a digital food thermometer when cooking at home.

Notice that the space between words is uniform in left-justified text.

In justified text, the spacing between words is irregular, slowing down the reader. Because a big space suggests a break between sentences, not a break between words, readers can become confused, frustrated, and fatigued.

Notice that the irregular spacing not only slows down reading but also can create "rivers" of white space. Readers are tempted to concentrate on the rivers running south rather than on the information itself.

Full justification can make the text harder to read in one more way. Some word processors and typesetting systems automatically hyphenate words that do not fit on the line. Hyphenation slows down and distracts the reader. Left-justified text does not require as much hyphenation as full-justified text.

TITLES AND HEADINGS

Titles and headings should stand out visually on the page because they introduce new ideas.

Titles Because the title is the most important heading in a document, it should be displayed clearly and prominently. On a cover page or a title page, use boldface type in a large size, such as 18 or 24 points. If the title also appears at the top of the first page, make it slightly larger than the rest of the text — perhaps 16 or 18 points for a document printed in 12 point — but smaller than it is on the cover or title page. Many designers center titles on the page between the right and left margins.

For more about titling your document, see Ch. 9, p. 194.

Headings Readers should be able to tell when you are beginning a new topic. The most effective way to distinguish one level of heading from another is to use size variations (Williams & Spyridakis, 1992). Most readers will notice a 20-percent size difference between an A head (a first-level heading) and a B head (a second-level heading). Boldface also sets off headings effectively. The least effective way to set off headings is underlining, because the underline obscures the descenders, the portions of some letters that extend below the body of the letters, such as in p and y.

In general, the more important the heading, the closer it is to the left margin: A heads usually begin at the left margin, B heads are often indented a half inch, and C heads are often indented an inch. Indented C heads can also be run into the text.

In designing headings, use line spacing carefully. A perceivable distance between a heading and the following text increases the impact of the heading. Consider these three examples:

For more about using headings, see Ch. 9, p. 194.

Summary

In this example, the writer has skipped a line between the heading and the text that follows it. The heading stands out clearly.

Summary

In this example, the writer has not skipped a line between the heading and the text that follows it. The heading stands out, but not as emphatically.

Summary. In this example, the writer has begun the text on the same line as the heading. This run-in style makes the heading stand out the least.

OTHER DESIGN FEATURES

Table 11.3 shows five other design features that are used frequently in technical communication: rules, boxes, screens, marginal glosses, and pull quotes.

TABLE 11.3 Additional Design Features for Technical Communication

Two types of rules are used here: vertical rules to separate the columns and horizontal rules to separate the items. Rules enable you to fit a lot of information on a page, but when overused they make the page look cluttered.



Rules. Rule is a design term for a straight line. You can add rules to your document using the drawing tools in a word processor. Horizontal rules can separate headers and footers from the body of the page or divide two sections of text. Vertical rules can separate columns on a multicolumn page or identify revised text in a manual. Rules exploit the principles of alignment and proximity.



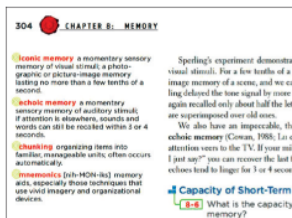
Markel/Selber, *Technical Communication*, 12e, © 2018
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The different-colored screens clearly distinguish the three sets of equations.



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The marginal glosses present definitions of key words.



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This pull quote extends into the margin, but a pull quote can go anywhere on the page, even spanning two or more columns or the whole page.



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Boxes. Adding rules on all four sides of an item creates a box. Boxes can enclose graphics or special sections of text or can form a border for the whole page. Boxed text is often positioned to extend into the margin, giving it further emphasis. Boxes exploit the principles of contrast and repetition.

Screens. The background shading used behind text or graphics for emphasis is called a *screen*. The density of a screen can range from 1 percent to 100 percent; 5 to 10 percent is usually enough to provide emphasis without making the text illegible. You can use screens with or without boxes. Screens exploit the principles of contrast and repetition.

Marginal glosses. A marginal gloss is a brief comment on the main discussion. Marginal glosses are usually set in a different typeface — and sometimes in a different color — from the main discussion. Although marginal glosses can be helpful in providing a quick overview of the main discussion, they can also compete with the text for readers' attention. Marginal glosses exploit the principles of contrast and repetition.

Pull quotes. A pull quote is a brief quotation (usually just a sentence or two) that is pulled from the text, displayed in a larger type size and usually in a different typeface, and sometimes enclosed in a box. Newspapers and magazines use pull quotes to attract readers' attention. Pull quotes are inappropriate for reports and similar documents because they look too informal. They are increasingly popular, however, in newsletters. Pull quotes exploit the principles of contrast and repetition.

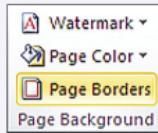
Why To Create Borders and Screens

You can use background borders and screens (or shading) in Microsoft Word to emphasize page elements such as text and graphics. By emphasizing certain elements, you are letting your readers know what is important.

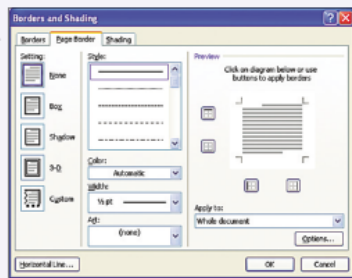
How To Create Borders and Screens

Start with the **Borders and Shading** dialog box.

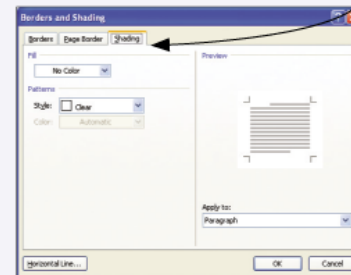
To create a **border** around a page element or an entire page, select the area you want to format. Select the **Page Layout** tab, and then select **Page Borders** in the **Page Background** group.



Select the **Borders** or **Page Border** tab. You can specify the type of border, line style, color, and line width.



To create **shading**, also called a screen, select the area you want to format, and then select **Page Borders** in the **Page Background** group. Select the **Shading** tab.



You can specify the color within the box as well as the style of the pattern.

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TECH TIP

Why To Create Text Boxes

In Microsoft Word, text boxes allow you to position words independently of the margins and other settings on the page. You can place a quotation in a text box, for example, and then position the box in the middle of a column of text to draw attention to the quote.

How To Create Text Boxes

Start with the **Text Box** feature in the **Text** group on the **Insert** tab.

To **create** a text box, select **Draw Text Box** from the **Text Box** drop-down menu.

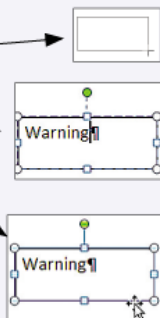


Click and drag your cursor to create your text box.

Click inside the text box and begin typing.

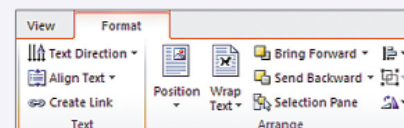
You can select the text box and move it around your page.

You can also insert a **built-in** text box from the **Text Box** drop-down menu.

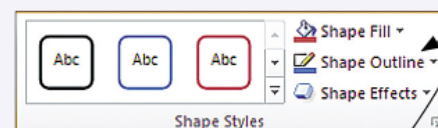


To **format** your text box, select the box and then select the **Format Shape** dialog-box launcher from the **Shape Styles** group on the **Format** tab.

The **Arrange** group allows you to specify design elements such as the text box's position in relation to other objects and the wrapping style of the surrounding text.



After selecting the box, you can also use buttons on the **Format** tab to specify such design elements as fill color, line color, font color, line style, and other effects.



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Designing Online Documents

The previous discussion of designing printed documents focused on four components: size, paper, bindings, and navigational aids. Of these four components, size and navigational aids or tools are relevant to websites and other online documents.

Size is important in that you can control — to some extent, at least — how much information (text, graphics, animation) you present on the screen. On all but the smallest screens, you can use multiple columns and vary column width, and you can fill screens with content (and thereby use fewer screens) or leave a lot of white space (and thereby use more screens). As people are increasingly turning to smaller screens for reading online content, you want to pay more attention to designing your information so that it is clear and attractive. You also want to be sure that you design the online document so that key information is emphasized and easily accessible to users. In addition, you want to consider audience characteristics such as age (use bigger type for older people) and disabilities (for example, include text versions of images so that people with vision disabilities can use software that “reads” your descriptions of the images). For more on accessibility for people with disabilities, see [pages 281–84](#).

Navigational tools are vitally important, because if your audience can’t figure out how to find the information they want, they’re out of luck. With a print document, they can at least flip through the pages.

The following discussion focuses on seven principles that can help you make it easy for readers to find and understand the information they seek:

- Use design to emphasize important information.
- Create informative headers and footers.
- Help readers navigate the document.
- Include extra features your readers might need.
- Help readers connect with others.
- Design for accessibility (for readers with disabilities).
- Design for multicultural readers.

Although some of these principles do not apply to every type of online document, they provide a useful starting point as you think about designing your document.

USE DESIGN TO EMPHASIZE IMPORTANT INFORMATION

The smaller the screen, the more cluttered it can become, making it difficult for readers to see what is truly important. No matter what size screen they are using, you want readers to be able to find what they want quickly and easily. As you begin planning an online document, decide what types of information are most essential for your audience, and ensure that that content in particular is clearly accessible from the home screen. Give your buttons, tabs, and other navigational features clear, informative headings. For more guidance on emphasizing important information, see [Chapter 9](#).

Once you have determined the information you want to emphasize, adhere to design principles rigorously so that users can easily identify key content. Use logical patterns of organization and the principles of proximity, alignment, repetition, and contrast so that readers know where they are and how to carry out the tasks they want to accomplish. [Figure 11.16](#) on page 278 shows a well-designed screen for a mobile phone.

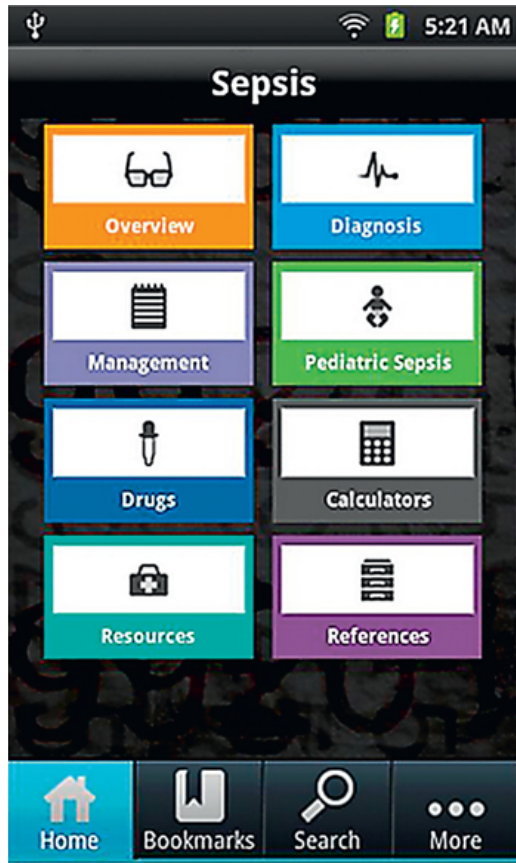


Figure 11.16
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 11.16 Screen for a Mobile Application

This app helps physicians diagnose sepsis quickly and effectively. The information most crucial to evaluating the condition is easily accessible on the home screen. At the top of the screen, where the reader's eyes will initially fall, is an overview of the condition and, most importantly, the diagnostic tool. Less essential items, such as resources and references, are located at the bottom of the screen. Supplementary information, such as a call for authors and a feedback form, is deeper on the site, behind the "More" tab.

This simple screen uses the principle of contrast effectively to highlight key content. Each of the eight main content areas has its own color and its own icon to distinguish it from the seven other areas. In addition, the four navigation items at the bottom of the screen use contrast in that the icon for the screen the reader is now viewing—in this case, the home page—is presented against a blue background, whereas the other three icons are presented against a black background.

DOCUMENT ANALYSIS ACTIVITY

Analyzing Page Designs

The two pages shown here come from different government reports. Both are printed on 8½ × 11-inch paper. The questions next to each ask you to think about page design as discussed in this chapter.

1. How many columns are used in this document? How does the column design affect the readability of the page?
2. What type of justification has been used for the text? Was this a wise choice for this page size? Why or why not?
3. What alignment features, if any, have been used? What problems with alignment, if any, do you see?

(f) *Drug Purity - DEA Form 7*

(1) The presentence report will normally provide drug weight/purity information from DEA Form 7. This is a complicated form. "Total net weight" [normally in Item 31] refers to the amount of the pure drug. This is the weight used in calculation of the Commission's severity rating. For your information, "gross weight" is the weight of the drug plus adulterants plus the container (normally found in Item 24). Also normally found in Item 24 is "net weight" (the weight of the drug plus adulterants). "Strength" (the percent purity of the drug) is normally found in Item 28. Multiplying "net weight" x "strength" is how DEA arrives at the "total net weight". Remember, "total net weight" is the weight of the pure drug to be used in assessing the Commission's severity rating.

(2) If a presentence report does not specify "total net weight", the probation officer should be contacted for clarification (please be specific as to the clarification necessary; this will enhance feedback/training). Note: DEA lab reports (DEA Form 7), if necessary, also may be obtained directly from the DEA field office for the geographic area in which the offense occurred. If a request to the DEA field office is required, provide the subject's name, date of birth, place of offense, and dates of offense.

(g) If neither weight nor purity is available, but only a money value, DEA may be requested to provide an estimate of the amount of pure drug associated with that money value. In the absence of a specific estimate from DEA pertaining to the particular case, DEA publishes a report (Domestic Drug Prices) providing estimates of average drug prices by year and region from which an estimate may be obtained.

(h) *Determining Offense Severity Relative to Simple Possession of Drugs.* In certain cases, the Commission must determine whether the offense behavior should be considered as "simple possession" of a controlled substance or "possession with intent to distribute." In making this determination, the Commission shall examine a variety of factors (if available). These factors are shown below. The presence of any of the following factors may be considered as a presumption of possession with intent to distribute. However, this presumption may be rebutted if there are circumstances in the individual case which indicate that there was no intention to distribute.

(1) *Weight/amount/purity of the substance:* Possession of the following amounts of controlled substances are presumed to indicate possession with intent to distribute:

Heroin 1 gm. at 100% purity, or equivalent amount; or more
Cocaine 5 gms. at 100% purity, or equivalent amount; or more
Marijuana 10 lbs. or more
Hashish 3 lbs. or more
Hash Oil .3 lbs. or more
Drugs (other than above) 1,000 doses or more.

(2) *Other Factors:* The presence of any of the following factors may be considered indicative of intent to distribute: (A) the substance has been separated into multiple, individual packets; (B) the offender is a non-user of the substance in question; (C) the presence of instruments used in preparing

*Terms marked by an asterisk are defined in Chapter Thirteen.

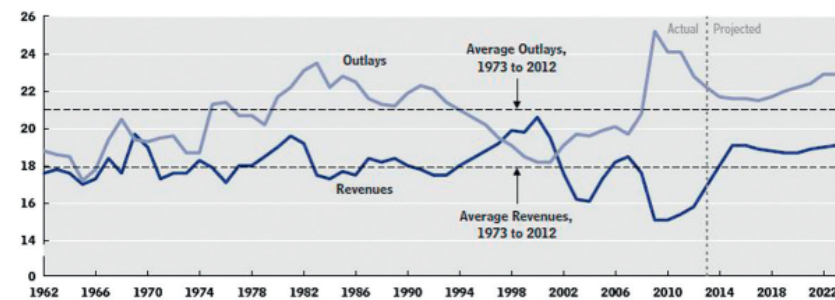
11/15/07 Page 60 of 337

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Department of Justice, 2010: www.justice.gov/uspc/rules_procedures/uspc-manual111507.pdf.

4. How many levels of headings appear on this page? Are the different levels designed effectively so that they are easy to distinguish? If not, what changes would you make to the design?
5. How are rules used on this page? Are they effective? Would you change any of them?
6. Describe the design of the body text on this page, focusing on columns and alignment. Is the design of the body text effective? Would you change it in any way?

Figure 1-2.**Total Revenues and Outlays**

(Percentage of gross domestic product)



Source: Congressional Budget Office.

health care costs, and a significant expansion in eligibility for federal subsidies for health insurance, outlays for Social Security and the federal government's major health care programs are projected to rise substantially relative to the size of the economy over the next 10 years. In addition, growing debt and rising interest rates will boost net interest payments. Spending on all other programs—in the aggregate—is projected to decline relative to GDP between 2014 and 2023, primarily because of improving economic conditions and the spending limits in current law.

Revenues

CBO projects that, if current tax laws remain unchanged, revenues will rise relative to GDP over the next two years and then remain at about 19 percent of GDP through 2023. After 2015, increases in individual income tax receipts relative to GDP will roughly offset projected declines in corporate income tax receipts and declines in remittances from the Federal Reserve as a share of GDP.

Individual Income Taxes. CBO projects that, under current law, individual income tax receipts will rise from \$1.3 trillion this year to \$2.5 trillion in 2023—or from 7.9 percent to 9.8 percent of GDP. The projected increase in receipts relative to the economy in CBO's baseline reflects real (inflation-adjusted) bracket creep, the economic expansion, recent and scheduled changes in tax provisions, and other factors. In previous baselines,

CBO had projected that those receipts would increase to a much higher percentage of GDP by the early part of the next decade, but the American Taxpayer Relief Act's permanent extension of most of the expiring income tax reductions has significantly reduced the amount of revenues anticipated under current law.

Real Bracket Creep. Increases in real income will push more income into higher tax brackets, which boosts revenues relative to GDP in CBO's projections by 0.9 percentage points over the next decade.¹¹

Economic Recovery. CBO expects that the economic expansion and related factors will cause taxable incomes to rise faster than GDP, boosting individual income tax revenues as a share of GDP by about 0.4 percentage points over the next decade; most of that effect will occur by 2017. Certain components of taxable income—including wages and salaries, capital gains realizations, interest income, and proprietors' income—declined as a share of GDP over the past several years. CBO expects that, as the economy recovers, such income will rebound more quickly than the economy as a whole, increasing

11. Roughly three-quarters of that amount is a longer-term effect that results from increases in the potential output of the economy (that is, the maximum sustainable level of economic output), and the rest results from the return of output to its potential level over the next several years.

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Information from U.S. Congressional Budget Office, 2013: www.cbo.gov/sites/default/files/cbofiles/attachments/43907-BudgetOutlook.pdf.

CREATE INFORMATIVE HEADERS AND FOOTERS

Headers and footers help readers understand and navigate your document, and they help establish your credibility. You want readers to know that they are reading an official document from your organization and that it was created by professionals. [Figure 11.17](#) shows a typical website header, and [Figure 11.18](#) shows a typical footer.

**Figure 11.17**

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from Michael J. Fox Foundation, 2013: www.michaeljfox.org.

FIGURE 11.17 Website Header

Notice that a header in a website provides much more accessing information than a header in a printed document. This header enables readers to search the site, as the header on almost every site does, but it also includes other elements that are particularly important to the Michael J. Fox Foundation. For instance, there is a link to drug trials that visitors might want to join, and there is a

prominent link for donating to the foundation.

The Michael J. Fox Foundation for Parkinson's Research, Grand Central Station, P.O. Box 4777, New York, NY 10163-4777. Tel: 1-800-708-7644
Copyright © 2013 Michael J. Fox Foundation. Privacy Policy | Terms & Conditions | Sitemap

Figure 11.18

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Text adapted from Federal Aviation Administration, 2016: www.faa.gov/uas/faqs/#ffr.

The top line of the footer contains the contact information for the site.

The bottom line contains the copyright notice, as well as links to the privacy policy, the terms and conditions for using the site, and a site map.

FIGURE 11.18 Website Footer

This simply designed footer presents all the links as text. Readers with impaired vision who use text-to-speech devices will be able to understand these textual links; they would not be able to understand graphical links.

HELP READERS NAVIGATE THE DOCUMENT

One important way to help readers navigate is to create and sustain a consistent visual design on every page or screen. Make the header, footer, background color or pattern, typography (typeface, type size, and color), and placement of the navigational links the same on every page. That way, readers will know where to look for these items.

GUIDELINES: Making Your Document Easy To Navigate

Follow these five suggestions to make it easy for readers to find what they want in your document.

- ▶ **Include a site map or index.** A site map, which lists the pages on the site, can be a graphic or a textual list of the pages, classified according to logical categories. An index is an alphabetized list of the pages. [Figure 11.19](#) shows a portion of a site map.
- ▶ **Use a table of contents at the top of long pages.** If your page extends for more than a couple of screens, include a table of contents — a set of links to the items on that page — so that your readers do not have to scroll down to find the topic they want. Tables of contents can link to information farther down on the same page or to information on separate pages. [Figure 11.20](#) shows an excerpt from the table of contents at the top of a frequently asked questions (FAQ) page.
- ▶ **Help readers get back to the top of long pages.** If a page is long enough to justify a table of contents, include a “Back to top” link (a textual link or a button or icon) before the start of each new chunk of information.
- ▶ **Include a link to the home page on every page.** This link can be a simple “Back to home page” textual link, a button, or an icon.
- ▶ **Include textual navigational links at the bottom of the page.** If you use buttons or icons for links, include textual versions of those links at the bottom of the page. Readers with impaired vision might use special software that reads the information on the screen. This software interprets text only, not graphics.

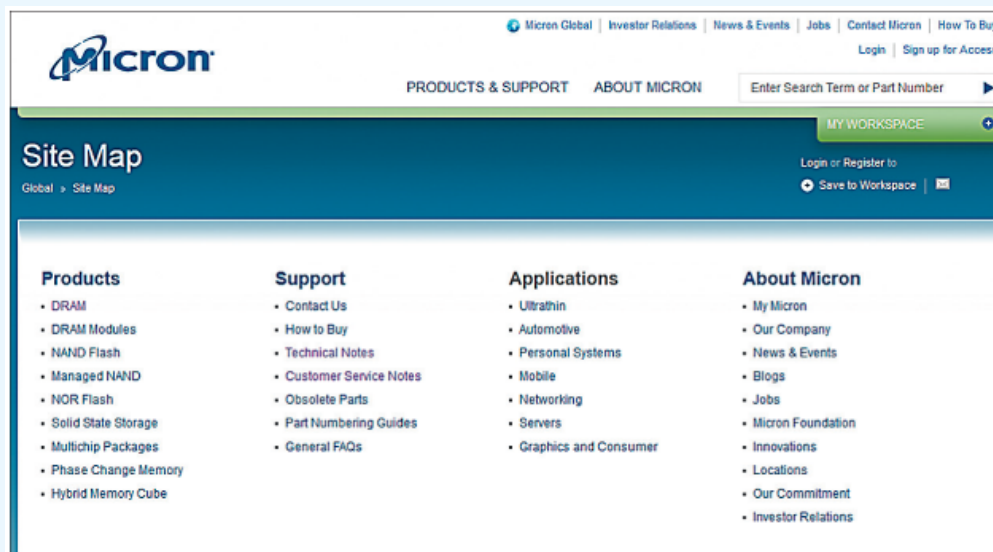


Figure 11.19

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
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FIGURE 11.19 Site Map

For large websites, help your readers by organizing the site map rather than just presenting an alphabetical list of the pages. In this portion of a site map, Micron Technology classifies the pages in logical categories to help visitors find the pages they seek.

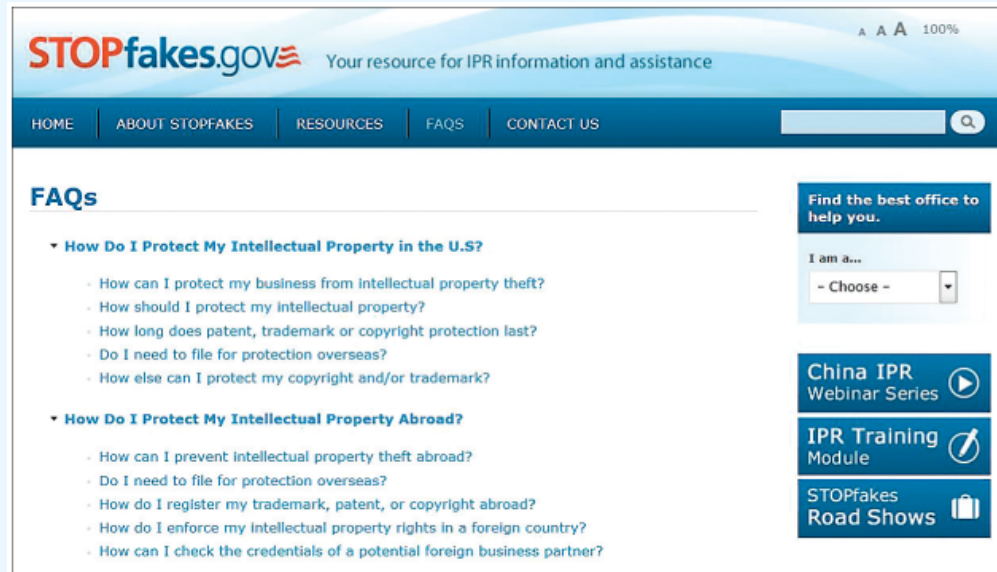


Figure 11.20

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Department of Commerce, 2013: www.stopfakes.gov/faqs.

FIGURE 11.20 Table of Contents

The table of contents is classified by topic (first all the topics about protecting your intellectual property in the United States, then all the topics about protecting it outside the United States). For any online document, large or small, use the principles of organizing information presented in [Chapter 7](#).

INCLUDE EXTRA FEATURES YOUR READERS MIGHT NEED

Because readers with a range of interests and needs will visit your site, consider adding some or all of the following four features:

- **An FAQ page.** A list of frequently asked questions helps new readers by providing basic information, explaining how to use the site, and directing them to more detailed discussions.
- **A search page or engine.** A search page or search engine enables readers to enter a keyword or phrase and find all the pages in the document that contain it.
- **Resource links.** If one of the purposes of your document is to educate readers, provide links to other sites.
- **A printable version of your site.** Online documents are designed for a screen, not a page. A printable version of your document, with black text on a white background and all the text and graphics consolidated into one big file, will save readers paper and toner.

HELP READERS CONNECT WITH OTHERS

Organizations use their online documents, in particular their websites, to promote interaction with clients, customers, suppliers, journalists, government agencies, and the general public. For this reason, most organizations use their sites to encourage their various stakeholders to connect with them through social media such as discussion forums and blogs.

Use your online document to direct readers to interactive features of your own website, as well as to your pages on social-media sites such as Facebook or Twitter. [Figure 11.21](#) on page 282 shows a portion of NASA's community page.



Figure 11.21
 Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
 Information from National Aeronautics and Space Administration, 2013: www.nasa.gov/socialmedia/.

FIGURE 11.21 Maintaining Communities

As a federal agency with a mission that includes public education, NASA has a robust social-media presence. NASA has dozens of accounts on Facebook and the other popular social-media platforms, and it offers many opportunities for scientists and the general public alike to stay connected through blogs, podcasts, chat rooms, and educational programs and activities on such topics as how to view the International Space Station.

CONSIDER MATTERS OF ACCESSIBILITY

According to Web Accessibility in Mind (WebAIM, 2016), an estimated 20 percent of the population has some form of visual, hearing, motor, or cognitive disability. Impairments vary widely in type and severity, but a significant number of people will be denied access to online material unless that material includes adaptations such as closed captioning of videos, links to audio for text files, and magnification of visuals. It's worth noting that such adaptations are also beneficial to people without disabilities who are in situations in which they need alternative accessibility — for example, when audio is unavailable or when they are using a very small screen.

Laws in the United States and throughout the world require that websites be accessible to people with disabilities. In addition to being a matter of ethics, accessibility also makes good business sense: why exclude any members of the population? Moreover, principles of accessible design generally coincide with principles of good design in general. The Worldwide Web Consortium (W3C), the governing body of the web, has produced a list of international guidelines for good web design. WebAIM summarizes these guidelines as the “POUR” principles: documents should be perceivable, operable, understandable, and robust.

- **Perceivable:** Content is available to the senses (vision and hearing primarily) either through the browser or through assistive technologies (e.g., screen readers, screen enlargers).
- **Operable:** Users can interact with all controls and interactive elements using either a mouse, a keyboard, or an assistive device.
- **Understandable:** Content is clear and limits confusion and ambiguity.
- **Robust:** A wide range of technologies (including old and new user agents and assistive technologies) can access the content.

When designing for web and mobile devices, it's helpful to consider matters of accessibility in the planning stages of your design. For example, keep in mind the space that may be needed for closed captioning to run at the bottom of the screen. Or think about the placement of labels on graphics that may be magnified to 200 percent of their original size. A more detailed list of design principles is included in the Guidelines box on [page 283](#).

GUIDELINES: Designing Accessible Websites

The following key principles of accessible design have been adapted from WebAIM (2016). Most accessibility principles can be implemented very easily and will not affect the overall look or “feel” of your website. This list does not cover all accessibility issues, but by addressing these eleven basic principles, you can ensure that your web content is more accessible to everyone.

- ▶ **Provide appropriate alternative text.** Alternative text is a textual alternative to non-text content, such as the graphics in web pages. It is especially helpful for people who are blind and rely on a screen reader to read the content of the website to them.
- ▶ **Provide appropriate document structure.** Headings, lists, and other structural elements lend meaning and structure to web pages. They can also facilitate keyboard navigation within the page.
- ▶ **Provide headers for data tables.** Tables are used online for layout and to organize data. Tables that are used to organize data should have appropriate column headers. Data cells should be associated with their appropriate headers, making it easier for users of screen readers to navigate and understand the data table.
- ▶ **Ensure that users can complete and submit all forms.** Ensure that every element of a form (text field, checkbox, dropdown list, etc.) has a label. Also make sure the user can submit the form and recover from any errors, such as the failure to fill in all required fields.
- ▶ **Ensure that links make sense out of context.** Every link should make sense if the link text is read by itself. Users of screen readers may choose to read only the links on a web page. Certain phrases like “click here” and “more” should be avoided.
- ▶ **Caption and provide transcripts for media.** Videos and live audio must have captions and a transcript. With archived audio, a transcript may be sufficient.
- ▶ **Ensure accessibility of non-HTML content.** PDF documents and other non-HTML content must be as accessible as possible. If you cannot make such content accessible, consider using HTML formatting instead or, at the very least, provide an accessible alternative. A PDF document should also include a series of tags to make it more accessible. A tagged PDF file looks the same as an untagged file, but it is almost always more accessible to a person using a screen reader.
- ▶ **Allow users to skip repetitive elements on the page.** You should provide a method that allows users to skip navigation or other elements that repeat on every page. This is usually accomplished by providing a “Skip to Main Content” or “Skip Navigation” link at the top of the page; such a link allows the user to jump to the main content of the page.
- ▶ **Do not rely on color alone to convey meaning.** The use of color can enhance comprehension, but do not use color alone to convey information. That information may not be available to a person who is colorblind and will be unavailable to users of screen readers.
- ▶ **Make sure content is clearly written and easy to read.** There are many ways to make your content easier to understand. Write clearly, use clear fonts, and use headings and lists appropriately.
- ▶ **Design to standards.** HTML-compliant and accessible pages are more robust and provide better search engine optimization. Cascading Style Sheets (CSS) allow you to separate content from presentation, providing more flexibility and making your content more accessible.

DESIGN FOR MULTICULTURAL AUDIENCES

Only about 9 percent of the people using the Internet are from North America ([Internet World Stats, 2016](#)). Therefore, it makes sense in planning your online documents to assume that many of your readers will not be proficient in English.

Planning for a multicultural website is similar to planning for a multicultural printed document:

- **Use common words and short sentences and paragraphs.**
- **Avoid idioms, both verbal and visual, that might be confusing.** For instance, don’t use sports metaphors, such as *full-court press*, or a graphic of an American-style mailbox to suggest an email link.
- **If a large percentage of your readers speak a language other than English, consider creating a version of your site in that language.** The expense can be considerable, but so can the benefits.

ETHICS NOTE

DESIGNING LEGAL AND HONEST ONLINE DOCUMENTS

You know that the words and images that you see on the Internet are covered by copyright, even if you do not see a copyright symbol. The only exception is information that is in the public domain either because it is not covered by copyright (such as information created by entities of the U.S. federal government), because copyright has expired (the author has been dead over 70 years), or because the creator of the

information has explicitly stated that the information is in the public domain and you are free to copy it.

But what about the design of a site? Almost all web designers readily admit to spending a lot of time looking at other sites and pages for inspiration. And they admit to looking at the computer code to see how that design was achieved. This is perfectly ethical. So is copying the code for routine elements such as tables. But is it ethical to download the code for a whole page, including the layout and the design, and then plug in your own data? No. Your responsibility is to create your own information, then display it with your own design.

For more about copyright law, see Ch. 2, [p. 24](#).

Designing Online Pages

Well-designed online pages are simple, with only a few colors and nothing extraneous. The text is easy to read and chunked effectively, and the links are written carefully so readers know where they are being directed.

AIM FOR SIMPLICITY

When you create an online document, remember that readers are increasingly likely to use it on a device with a small screen. In addition, they will likely read in noisy, distracting environments with too much light or not enough light. For these reasons, keep the design as simple as you can. A good example of an app designed for a small screen can be seen in [Figure 11.22](#).

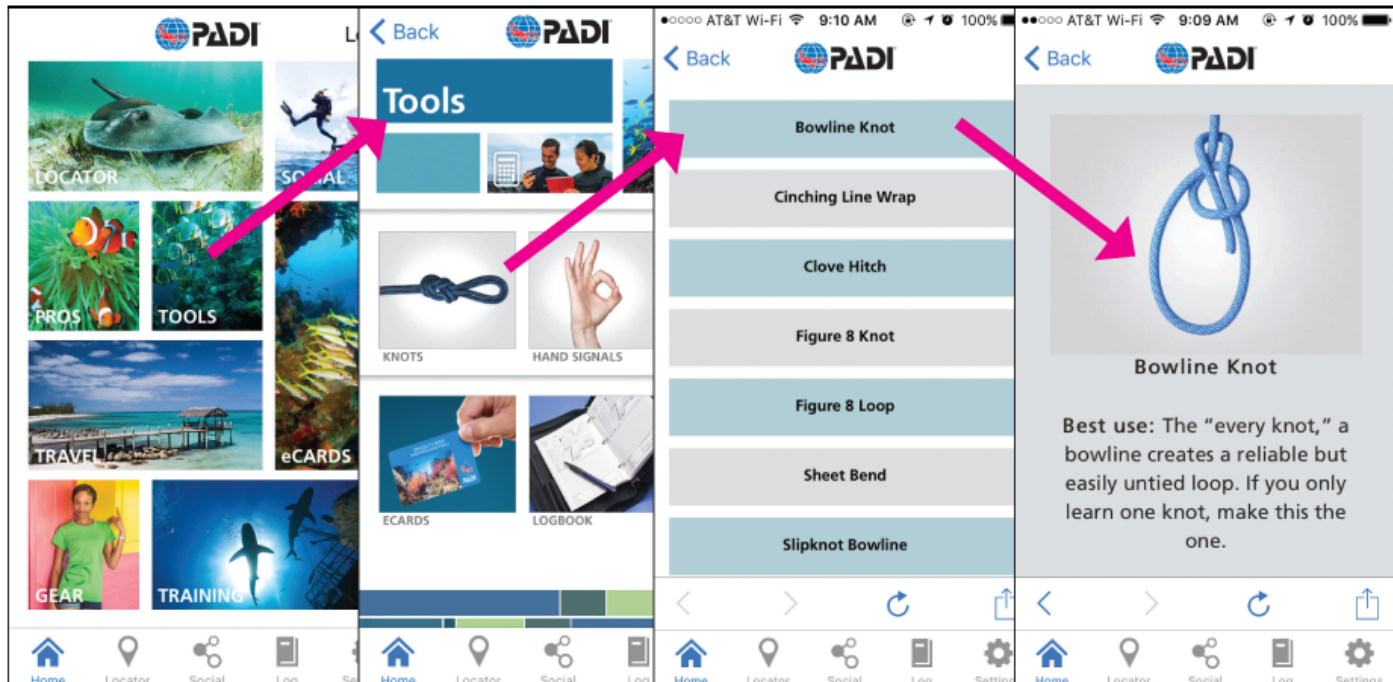


Figure 11.22

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Printed with permission of PADI.

FIGURE 11.22 Simply Designed Smartphone App

The PADI (Professional Association of Dive Instructors) smartphone app for scuba divers uses bright, colorful, and simple thumbnail images to link its homepage to more detailed information. For example, within the “Knots” tool, users can choose from several types of knots, then view an animation demonstrating how to make each knot and read about best uses.

GUIDELINES: Designing a Simple Site

Follow these four suggestions to make your design attractive and easy to use.

- ▶ **Use simple backgrounds.** A plain background is best. Avoid busy patterns that distract the reader from the words and graphics of the text.
- ▶ **Use conservative color combinations to increase text legibility.** The greater the contrast between the text color and the background color, the more legible the text. The most legible color combination is black text against a white background. Bad idea: black on purple.
- ▶ **Avoid decorative graphics.** Don't waste space using graphics that convey no useful information. Think twice before you use clip art.
- ▶ **Use thumbnail graphics.** Instead of a large graphic, which takes up space, requires a long time to download, and uses up your reader's data-download allotment, use a thumbnail that readers can click on if they wish to open a larger version.

MAKE THE TEXT EASY TO READ AND UNDERSTAND

Online pages are harder to read than paper documents because screen resolution is less sharp. [Figure 11.23](#) on page 287 is a good illustration of a website design that makes the small print easy to read and understand.

4. Our Rights & Obligations	
We may change or discontinue Services, and in such case, we do not promise to keep showing or storing your information and materials.	A. Services Availability For as long as LinkedIn continues to offer the Services, LinkedIn shall provide and seek to update, improve and expand the Services. As a result, we allow you to access LinkedIn as it may exist and be available on any given day and we have no other obligations, except as expressly stated in this Agreement. We may modify, replace, refuse access to, suspend or discontinue LinkedIn, partially or entirely, or change and modify prices prospectively for all or part of the Services for you or for all our Members in our sole discretion. All of these changes shall be effective upon their posting on LinkedIn or by direct communication to you unless otherwise noted. LinkedIn further reserves the right to withhold, remove or discard any content available as part of your account, with or without notice if deemed by LinkedIn to be contrary to this Agreement. For avoidance of doubt, LinkedIn has no obligation to store, maintain or provide you a copy of any content that you or other Members provide when using the Services.
Third parties may offer their own products and services through LinkedIn, and we are not responsible for these third-party activities.	B. Third Party Sites and Developers LinkedIn may include links to third party web sites ("Third Party Sites") on www.linkedin.com , developer.linkedin.com , and elsewhere. LinkedIn also enables third party developers ("Platform Developers") to create applications ("Platform Applications") that provide features and functionality using data and developer tools made available by LinkedIn through its developer platform. You are responsible for evaluating whether you want to access or use a Third Party Site or Platform Application. You should review any applicable terms or privacy policy of a Third Party Site or Platform Application before using it or sharing any information with it, because you may give the third-party permission to use your information in ways we would not. LinkedIn is not

Nobody likes user agreements, and few people read them carefully. LinkedIn, the online professional network, uses a simple table design to make its user agreement a little easier to read.

In this excerpt, the left column presents a simple overview of a portion of the agreement. The right column presents the "small print": the specific provision, including links to even more detailed information.

Figure 11.23

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from LinkedIn, 2013: <http://www.linkedin.com/legal/user-agreement>.

FIGURE 11.23 Making the Small Print a Little Larger

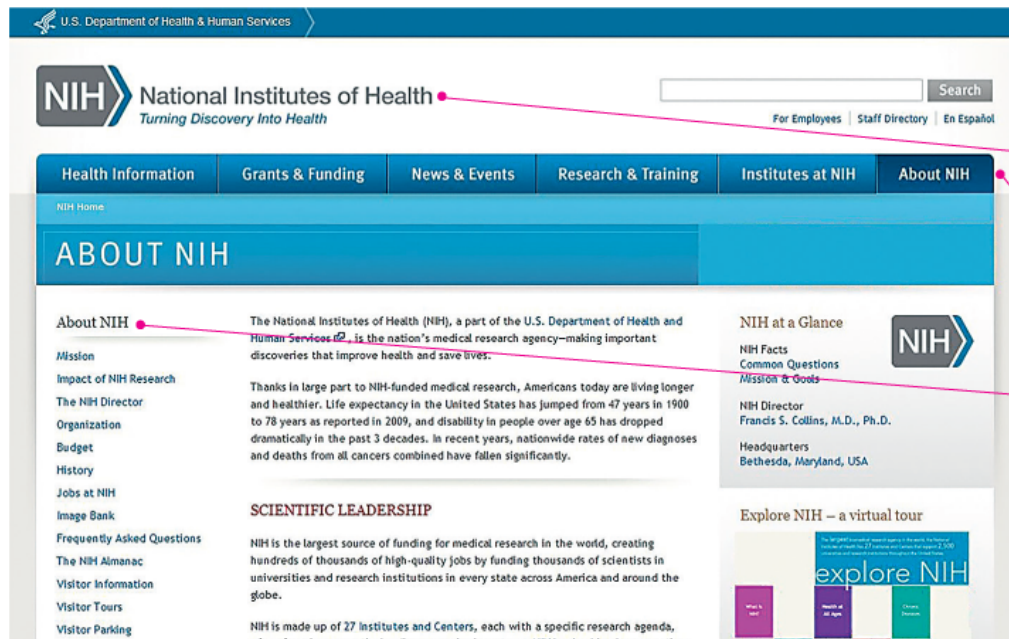
GUIDELINES: Designing Easy-To-Read Text

Follow these three suggestions to make the text on your sites easy to read.

- ▶ **Keep the text short.** Poor screen resolution makes reading long stretches of text difficult. In general, pages should contain no more than two or three screens of information.
- ▶ **Chunk information.** When you write for the screen, chunk information to make it easier to understand. Use frequent headings, brief paragraphs, and lists.
For more about chunking, see Ch. 11, p. 259.
- ▶ **Make the text as simple as possible.** Use common words and short sentences to make the information as simple as the subject allows.

CREATE CLEAR, INFORMATIVE LINKS

Well-phrased links are easy to read and understand. By clearly indicating what kind of information the linked site provides, links can help readers decide whether to follow them. [Figure 11.24](#) is a good illustration of a website with clear, informative links. The following guidelines box is based on *Web Style Guide Online* ([Lynch & Horton, 2011](#)).



The About NIH page on the National Institutes of Health website conveys its message simply but effectively.

The top row is reserved for the name of this government agency.

Below the agency's name is the main navigation pane, beginning with "Health Information."

Below the main navigation pane is the navigation pane for the section in which this page appears: "About NIH." The About NIH page has 18 sections, beginning with "Mission."

Figure 11.24
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from National Institutes of Health: www.nih.gov.

FIGURE 11.24 An About Us Page with Clear, Informative Links

GUIDELINES: Writing Clear, Informative Links

Links are critically important. Follow these three suggestions to make them easy to use.

► Structure your sentences as if there were no links in your text.

- | | |
|----------------|--|
| AWKWARD | Click here to go to the Rehabilitation Center page, which links to research centers across the nation. |
| SMOOTH | The Rehabilitation Center page links to research centers across the nation. |

► Indicate what information the linked page contains. Readers get frustrated if they wait for a web file to download and then discover that it doesn't contain the information they expected.

- | | |
|----------------------|--|
| UNINFORMATIVE | See the Rehabilitation Center . |
| INFORMATIVE | See the Rehabilitation Center's hours of operation . |

► Use standard colors for text links. Readers are used to seeing blue for links that have not yet been clicked and purple for links that have been clicked. If you have no good reason to use other colors, stick with the ones most readers expect.

WRITER'S CHECKLIST

Did you

- ☐ analyze your audience: their knowledge of the subject, their attitudes, their reasons for reading, and the kinds of tasks they will be carrying out? ([p. 250](#))
- ☐ consider the purpose or purposes you are trying to achieve? ([p. 253](#))
- ☐ determine your resources in time, money, and equipment? ([p. 253](#))

Designing Print Documents and Pages

Did you

- ☐ consider the best size for the document? ([p. 254](#))
- ☐ consider the best paper? ([p. 254](#))
- ☐ consider the best binding? ([p. 255](#))
- ☐ think about which navigational aids would be most appropriate, such as icons, color, dividers and tabs, and cross-reference tables? ([p. 256](#))
- ☐ use color, if available, to highlight certain items, such as warnings? ([p. 257](#))
- ☐ devise a style for headers and footers? ([p. 257](#))
- ☐ devise a style for page numbers? ([p. 258](#))
- ☐ employ learning theory principles of chunking, queuing, and filtering? ([p. 259](#))
- ☐ draw thumbnail sketches and page grids that define columns and white space? ([p. 260](#))
- ☐ choose typefaces that are appropriate for your subject? ([p. 263](#))
- ☐ use appropriate styles from the type families? ([p. 266](#))
- ☐ use type sizes that are appropriate for your subject and audience? ([p. 267](#))
- ☐ choose a line length that is suitable for your subject and audience? ([p. 268](#))
- ☐ choose line spacing that is suitable for your line length, subject, and audience? ([p. 268](#))
- ☐ consider whether to use left-justified text or full-justified text? ([p. 269](#))
- ☐ design your title for clarity and emphasis? ([p. 269](#))
- ☐ devise a logical, consistent style for each heading level? ([p. 270](#))
- ☐ use rules, boxes, screens, marginal glosses, and pull quotes where appropriate? ([p. 271](#))

Designing Online Documents and Pages

Did you

- ☐ create informative headers and footers? ([p. 278](#))
- ☐ help readers navigate the site by including a site map, a table of contents, "Back to top" links, and textual navigation buttons? ([p. 279](#))
- ☐ include extra features your readers might need, such as an FAQ page, a search page or engine, resource links, or a printable version of your site? ([p. 281](#))
- ☐ help readers connect with others through links to interactive portions of your site and to social-media sites? ([p. 281](#))
- ☐ consider matters of accessibility? ([p. 281](#))
- ☐ design for multicultural audiences? ([p. 284](#))
- ☐ aim for simplicity in web page design by using simple backgrounds and conservative color combinations and by avoiding decorative graphics? ([p. 285](#))
- ☐ make the text easy to read and understand by keeping it short, chunking information, and writing simply? ([p. 286](#))
- ☐ create clear, informative links? ([p. 286](#))

EXERCISES

For more about memos, see Ch. 14, [p. 376](#).

1. Study the first and second pages of an article in a journal in your field. Describe ten design features on these two pages. Which design features are most effective for the audience and purpose? Which are least effective?
2. **TEAM EXERCISE** Form small groups for this collaborative exercise in analyzing design. Photocopy or scan a page from a book or a magazine. Choose a page that does not contain advertisements. Each person works independently for the first part of this project:

- One person describes the design elements.
- One person evaluates the design. Which aspects of the design are effective, and which could be improved?
- One person creates a new design using thumbnail sketches.

Then meet as a group and compare notes. Do all members of the group agree with the first member's description of the design? With the second member's evaluation of the design? Do all members like the third member's redesign? What have your discussions taught you about design? Write a memo to your instructor presenting your findings, and include the photocopy or scan of the page with your memo.

3. Study the following excerpt from a Micron data flyer (2012, p. 1). Describe the designer's use of the design principle of alignment. How effective is it? How would you modify it? Present your analysis and recommendations in a brief memo to your instructor.

Customer Service Note

BGA Manufacturer's User Guide for Micron BGA Parts

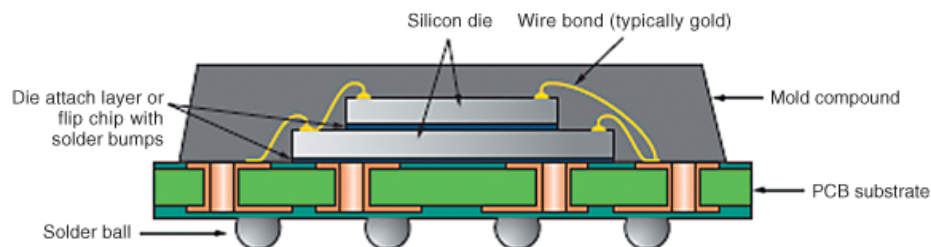
Introduction

This customer service note provides information that will enable customers to easily integrate both leading-edge and legacy Micron® ball grid array (BGA) packages into their manufacturing processes. It is intended as a set of high-level guidelines and a reference manual describing typical package-related and manufacturing process-flow practices. The recommendations and suggestions provided in this customer service note serve as a guideline to help the end user to develop user-specific solutions. It is the responsibility of the end user to optimize the process to obtain the desired results.

Because the package landscape changes rapidly and information can become outdated very quickly, refer to the latest product specifications. Contact your sales representative for any additional questions not covered within this guide.

An overview of a typical BGA package and its components are shown in Figure 1.

Figure 1: Ball Grid Array Package (Dual Die, Wire Bonded)



JEDEC Terminology

This document uses JEDEC terminology. JEDEC-based BGA devices in the semiconductor industry are identified by two key attributes:

- Maximum package height (profile)
- Ball pitch

For example: TFBGA - 1.2mm package height and less than 1.0mm ball pitch.

Package descriptors F1 through F6 have been added to provide more detailed ball pitch information for devices with a ball pitch of less than 0.8mm. Within the industry, many memory manufacturers continue to use only the “F” descriptor for any ball pitch of 1.0mm or less (see JEDEC JESD30E for additional information). Maximum package height profile and ball pitch codes based on the JEDEC standard are shown in Tables 1

4. Find the websites of three manufacturers within a single industry, such as personal watercraft, cars, computers, or medical equipment. Study the three sites, focusing on one of these aspects of site design:

- use of color
- quality of the writing
- quality of the site map or index
- navigation, including the clarity and placement of links to other pages in the site
- accommodation of multicultural readers
- accommodation of people with disabilities
- phrasing of the links

Which of the three sites is most effective? Which is least effective? Why? Compare and contrast the three sites in terms of their effectiveness.

5. Using a search engine, find a website that serves the needs of people with a physical disability (for example, the Glaucoma Foundation, www.glaucomafoundation.org). What attempts have the designers made to accommodate the needs of visitors to the site? How effective do you think those attempts have been?

CASE 11: Designing a Flyer

As an employee in the educational information office in the U.S. Department of Education, you have been asked by your supervisor to design a flyer for international students hoping to complete graduate school in the United States. She's given you a text document with all of the relevant information; it's your job to turn that information into a visually appealing flyer that will catch students' attention. Your supervisor has asked you to write her a memo before you begin, describing and defending the design you have in mind. To get started designing your flyer, go to LaunchPad.



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CHAPTER 12

Creating Graphics

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[ILLUSTRATING LOGICAL RELATIONSHIPS](#)

- [Document Analysis Activity: Analyzing a Graphic](#)
- [Document Analysis Activity: Mechanism Description Using Interactive Graphics](#) 

[ILLUSTRATING PROCESS DESCRIPTIONS AND INSTRUCTIONS](#)

[ILLUSTRATING VISUAL AND SPATIAL CHARACTERISTICS](#)

[TUTORIAL: Photo Editing Basics with GIMP](#) 

- [GUIDELINES: Presenting Photographs Effectively](#)
- [TECH TIP: Why and How To Create and Insert Screen Shots](#)

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[CASE 12: Creating Appropriate Graphics To Accompany a Report](#)

The Functions of Graphics

We have known for decades that graphics motivate people to study documents more closely. Some 83 percent of what we learn derives from what we see, whereas only 11 percent derives from what we hear ([Gatlin, 1988](#)). Because we are good at acquiring information through sight, a document that includes a visual element in addition to the words is more effective than one that doesn't. People studying a document with graphics learn about one-third more than people studying a document without graphics ([Levie & Lentz, 1982](#)). And people remember 43 percent more when a document includes graphics ([Morrison & Jimmerson, 1989](#)). In addition, readers like graphics. According to one survey, readers of computer documentation consistently want more graphics and fewer words ([Brockmann, 1990](#), p. 203).

Graphics offer five benefits that words alone cannot:

- **Graphics are indispensable in demonstrating logical and numerical relationships.** For example, an organization chart effectively represents the lines of authority in an organization. And if you want to communicate the number of power plants built in each of the last 10 years, a bar graph works better than a paragraph.
- **Graphics can communicate spatial information more effectively than words alone.** If you want to show the details of a bicycle derailleur, a diagram of the bicycle with a close-up of the derailleur is more effective than a verbal description.
- **Graphics can communicate steps in a process more effectively than words alone.** A troubleshooter's guide, a common kind of table, explains what might be causing a problem in a process and how you might fix it. And a diagram can show clearly how acid rain forms.
- **Graphics can save space.** Consider the following paragraph:

In the Wilmington area, some 80 percent of the population aged 18 to 24 have watched streamed movies on their computers. They watch an average of 1.86 movies a week. Among 25- to 34-year-olds, the percentage is 72, and the average number of movies is 1.62. Among 35- to 49-year-olds, the percentage is 62, and the average number of movies is 1.19. Among the 50 to 64 age group, the percentage is 47, and the number of movies watched averages 0.50. Finally, among those people 65 years old or older, the percentage is 28, and the average number of movies watched weekly is 0.31.

Presenting this information in a paragraph is uneconomical and makes the information hard to remember. Presented as a table, however, the information is more concise and more memorable.

AGE	PERCENTAGE WATCHING STREAMED MOVIES	NUMBER OF MOVIES WATCHED PER WEEK
18–24	80	1.86
25–34	72	1.62
35–49	62	1.19
50–64	47	0.50
65+	28	0.31

- **Graphics can reduce the cost of documents intended for international readers.** Translation costs more than 10 cents per word ([ProZ.com, 2013](#)). Used effectively, graphics can reduce the number of words you have to translate.

As you plan and draft your document, look for opportunities to use graphics to clarify, emphasize, summarize, and organize information.

The Characteristics of an Effective Graphic

To be effective, graphics must be clear, understandable, and meaningfully related to the larger discussion. Follow these five principles:

- **A graphic should serve a purpose.** Don't include a graphic unless it will help readers understand or remember information. Avoid content-free photographs and clip art, such as drawings of businesspeople shaking hands.
- **A graphic should be simple and uncluttered.** Three-dimensional bar graphs are easy to make, but they are harder to understand than two-dimensional ones, as shown in [Figure 12.1](#).
- **A graphic should present a manageable amount of information.** Presenting too much information can confuse readers. Consider audience and purpose: what kinds of graphics are your readers familiar with, how much do they already know about the subject, and what do you want the document to do? Because readers learn best if you present information in small chunks, create several simple graphics rather than a single complicated one.
- **A graphic should meet readers' format expectations.** Through experience, readers learn how to read different kinds of graphics. Follow the conventions — for instance, use diamonds to represent decision points in a flowchart — unless you have a good reason not to.
- **A graphic should be clearly labeled.** Give every graphic (except a brief, informal one) a unique, clear, informative title. Fully label the columns of a table and the axes and lines of a graph. Don't make readers guess whether you are using meters or yards, or whether you are also including statistics from the previous year.

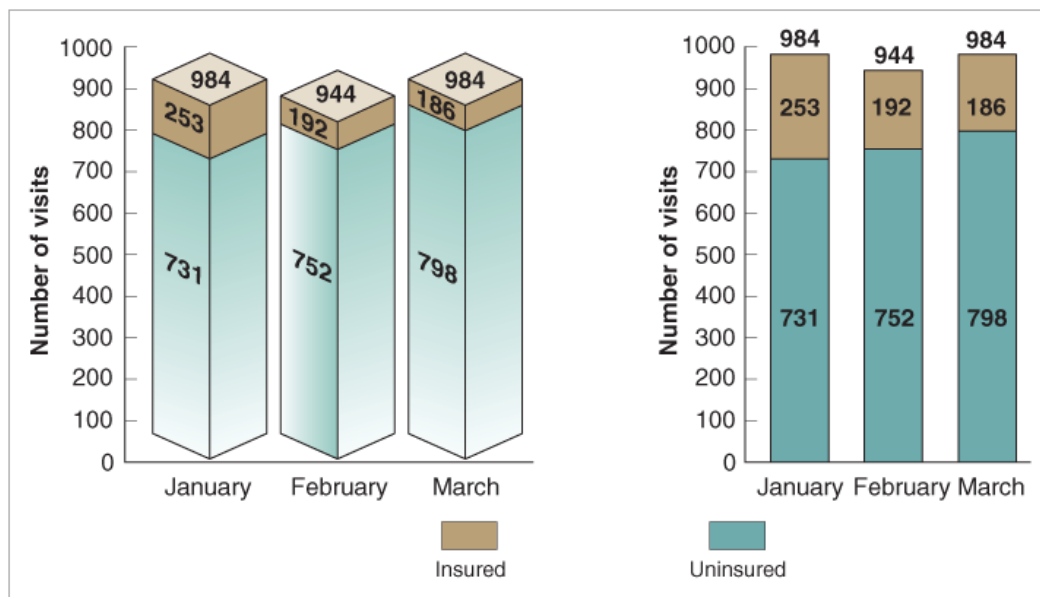


Figure 12.1
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FIGURE 12.1 Chartjunk and Clear Art

Unnecessary 3D is one example of chartjunk, a term used by [Tufte \(1983\)](#) to describe the ornamentation that clutters up a graphic, distracting readers from the message.

The two-dimensional bar graph is clean and uncluttered; the three-dimensional graph is more difficult to understand because the additional dimension obscures the main data points. The number of uninsured emergency-room visits in February, for example, is very difficult to see in the three-dimensional graph.

ETHICS NOTE

CREATING HONEST GRAPHICS

Follow these six suggestions to ensure that you represent data honestly in your graphics.

- If you did not create the graphic or generate the data, cite your source. If you want to publish a graphic that you did not create, obtain permission. For more on citing graphics, see [page 300](#).
- Include all relevant data. For example, if you have a data point that you cannot explain, do not change the scale to eliminate it.

- Begin the axes in your graphs at zero — or mark them clearly — so that you represent quantities honestly.
- Do not use a table to hide a data point that would be obvious in a graph.
- Show items as they really are. Do not manipulate a photograph of a computer monitor to make the screen look bigger than it is, for example.
- Do not use color or shading to misrepresent an item's importance. A light-shaded bar in a bar graph, for example, appears larger and nearer than a dark-shaded bar of the same size.

Common problem areas are pointed out in the discussions of various kinds of graphics throughout this chapter.

GUIDELINES: Integrating Graphics and Text

It is not enough to add graphics to your text; you have to integrate the two.

- ▶ **Place the graphic in an appropriate location.** If readers need the graphic in order to understand the discussion, put it directly after the relevant point in the discussion or as soon after it as possible. If the graphic merely supports or elaborates a point, include it as an appendix.
- ▶ **Introduce the graphic in the text.** Whenever possible, refer to a graphic before it appears (ideally, on the same page). Refer to the graphic by number (such as “see Figure 7”). Do not refer to “the figure above” or “the figure below,” because the graphic might move during the production process. If the graphic is in an appendix, cross-reference it: “For complete details of the operating characteristics, see Appendix B, page 00.”
- ▶ **Explain the graphic in the text.** State what you want readers to learn from it. Sometimes a simple paraphrase of the title is enough: “Figure 2 compares the costs of the three major types of coal gasification plants.” At other times, however, you might need to explain why the graphic is important or how to interpret it. If the graphic is intended to make a point, be explicit:

As Figure 2 shows, a high-sulfur bituminous coal gasification plant is more expensive than either a low-sulfur bituminous or an anthracite plant, but more than half of its cost is for cleanup equipment. If these expenses could be eliminated, high-sulfur bituminous would be the least expensive of the three types of plants.

In addition to text explanations, graphics are often accompanied by captions, ranging from a sentence to several paragraphs.
- ▶ **Make the graphic clearly visible.** Distinguish the graphic from the surrounding text by adding white space around it, placing rules (lines) above and below it, putting a screen behind it, or enclosing it in a box.
- ▶ **Make the graphic easy to find.** If the document is more than a few pages long and contains more than four or five graphics, consider including a list of illustrations so that readers can find them easily.

For more about white space, screens, boxes, and rules, see Ch. 11, [pp. 261](#) and 271–72. For more about lists of illustrations, see Ch. 18, [p. 483](#).

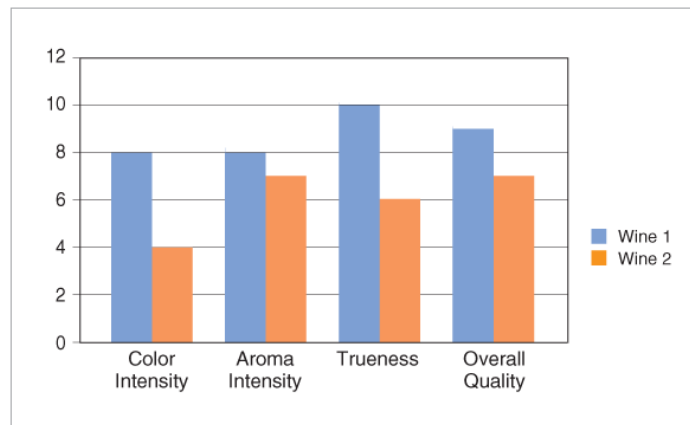
Understanding the Process of Creating Graphics

Creating graphics involves planning, producing, revising, and citing.

PLANNING GRAPHICS

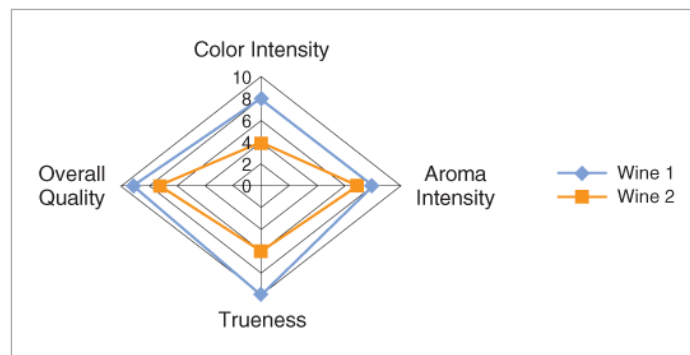
Whether you focus first on the text or the graphics, consider the following four issues as you plan your graphics.

- **Audience.** Will readers understand the kinds of graphics you want to use? Will they know the standard icons in your field? Are they motivated to read your document, or do you need to enliven the text — for example, by adding color for emphasis — to hold their attention? General audiences know how to read common types of graphics, such as those that appear frequently in newspapers or on popular websites. A general audience, for example, could use this bar graph to compare two bottles of wine:



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However, they would probably have trouble with the following radar graph:

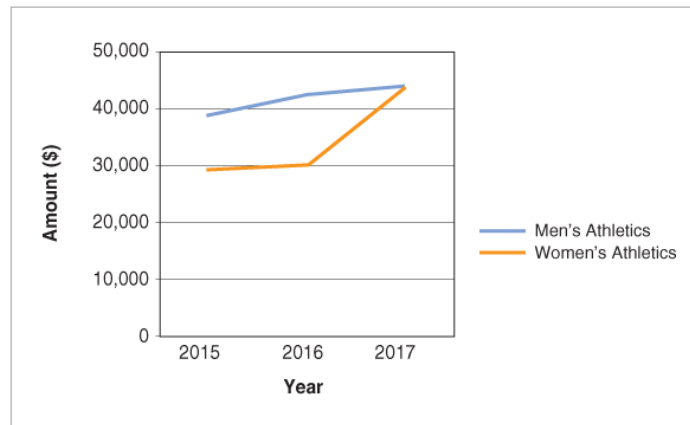


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- **Purpose.** What point are you trying to make with the graphic? Imagine what you want your readers to know and do with the information. For example, if you want readers to know the exact dollar amounts spent on athletics by a college, use a table:

YEAR	MEN'S ATHLETICS (\$)	WOMEN'S ATHLETICS (\$)
2015	38,990	29,305
2016	42,400	30,080
2017	44,567	44,213

If you want readers to know how spending on athletics is changing over time, use a line graph:



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- **The kind of information you want to communicate.** Your subject will help you decide what type of graphic to include. For example, in writing about languages spoken by your state's citizens, you might use a table for the statistical data, a map for the patterns of language use, and a graph for statistical trends over time.
- **Physical conditions.** The physical conditions in which readers will use the document — amount of lighting, amount of surface space available, the size of the screen on which the information will be displayed, and so forth — will influence the type of graphic as well as its size and shape, the thickness of lines, the size of type, and the color.

As you plan how you are going to create the graphics, consider four important factors:

- **Time.** Because making a complicated graphic can take a lot of time, you need to establish a schedule.

For more about planning and budgeting, see Ch. 3, [p. 48](#).

- **Money.** Creating a high-quality graphic can be expensive. How big is the project budget? How can you use that money effectively?
- **Equipment.** Determine what tools and software you will require, such as spreadsheets for tables and graphs or graphics software for diagrams.
- **Expertise.** How much do you know about creating graphics? Do you have access to the expertise of others?

PRODUCING GRAPHICS

Usually, you won't have all the resources you would like. You will have to choose one of the following four approaches:

- **Use existing graphics.** For a student paper that *will not be published*, some instructors allow the use of copied and pasted existing graphics; other instructors do not. For a document that *will be published*, whether written by a student or a professional, using an existing graphic is permissible if the graphic is in the public domain (that is, not under copyright), if it is the property of the writer's organization, or if the organization has obtained permission to use it. Be particularly careful about graphics you find on the web. Many people mistakenly think that anything on the web can be used without permission. The same copyright laws that apply to printed material apply to web-based material, whether words or graphics. For more on citing graphics, see [page 300](#).

Aside from the issue of copyright, think carefully before you use existing graphics. The style of the graphic might not match that of the others you want to use; the graphic might lack some features you want or include some you don't. If you use an existing graphic, assign it your own number and title.

- **Modify existing graphics.** You can redraw an existing graphic or use a scanner to digitize the graphic and then modify it electronically with graphics software. The same copyright laws that apply to existing graphics also apply to modified graphics. See [page 300](#) for more on citing graphics.
- **Create graphics on a computer.** You can create many kinds of graphics using your spreadsheet software and the drawing tools on your word processor. Consult the Selected Bibliography, [page 698](#), for a list of books about computers and technical communication.
- **Have someone else create the graphics.** Professional-level graphics software can cost hundreds of dollars and require hundreds of hours of practice. Some companies have technical-publications departments with graphics experts, but others subcontract this work. Many print shops and service bureaus have graphics experts on staff or can direct you to them.

For more about work made for hire, see Ch. 2, [p. 24](#).

TECH TIP

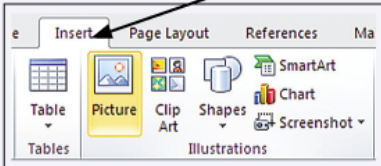
Why To Insert and Modify Graphics

You can insert graphics into your document in order to highlight, clarify, summarize, and/or organize information. You may have access to graphics, from online stock photo agencies or your company's graphics library, that could benefit from some modification.

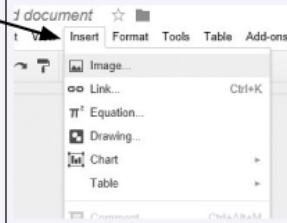
How To Insert and Modify Graphics

To **insert a graphic**—such as a photograph, drawing, chart, or graph—into your document, place your cursor where you want to make the insertion. From the **Insert** tab in either Microsoft Word or Google Docs, choose the type of item you wish to insert.

Microsoft Word

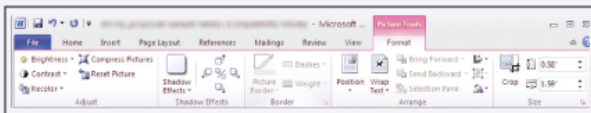


Google Docs

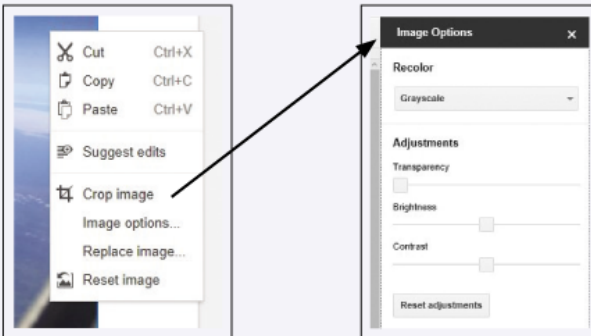


To **modify a graphic**, select it and then work with the range of tools available in your program, which can usually be seen by right-clicking on the graphic. Typical commands relate to cropping, resizing, and making adjustments to color, brightness, and contrast.

Microsoft Word



Google Docs



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Note that even if you create a graphic yourself or hire someone to create one for you, you need to cite the source of any copyright-protected information used to create it.

REVISING GRAPHICS

As with any other aspect of technical communication, build in enough time and budget enough money to revise the graphics you want to use. Create a checklist and evaluate each graphic for effectiveness. The Writer's Checklist at the end of this chapter is a good starting point. Show your graphics to people whose backgrounds are similar to those of your intended readers and ask them for suggestions. Revise the graphics and solicit more reactions.

CITING SOURCES OF GRAPHICS

If you wish to publish a graphic that is protected by copyright (even if you have revised it), you need to obtain written permission from the copyright holder. The same goes for any copyright-protected information you use to create a graphic. Related to the issue of permission is the issue of citation. Of course, you do not have to cite the source of a graphic if you created it yourself, if it is not protected by copyright, or if your organization owns the copyright.

For more information about copyright, see Ch. 2, [p. 24](#).

In all other cases, however, you should include a source citation, even if your document is a course assignment and will not be published. Citing the sources of graphics, even those you have revised substantially, shows your instructor that you understand professional conventions and your ethical responsibilities.

If you are following a style manual, check to see whether it presents a format for citing sources of graphics. In addition to citing a graphic's source in the reference list, most style manuals call for a source statement in the caption:

For more about style manuals, see [Appendix, Part B, p. 620](#).

PRINT SOURCE

Source: Verduijn, 2015, p. 14. Copyright 2015 by Tedopres International B.V. Reprinted with permission.

ONLINE SOURCE

Source: Johnson Space Center Digital Image Collection. Copyright 2015 by NASA. Reprinted with permission.

If your graphic is based on an existing graphic or based on copyright-protected information from another source, the source statement should state that your graphic is “based on” or “adapted from” your source:

Source: Adapted from Jonklaas et al., 2011, p. 771. Copyright 2008 by American Medical Association.
Reprinted with permission.

Using Color Effectively

Color draws attention to information you want to emphasize, establishes visual patterns to promote understanding, and adds interest. But it is also easy to misuse. The following discussion is based on [Jan V. White's excellent text *Color for the Electronic Age* \(1990\)](#).

In using color in graphics and page design, keep these six principles in mind:

- **Don't overdo it.** Readers can interpret only two or three colors at a time. Use colors for small items, such as portions of graphics and important words. And don't use colors where black and white will work better.
- **Use color to emphasize particular items.** People interpret color before they interpret shape, size, or placement on the page. Color effectively draws readers' attention to a particular item or group of items on a page. In [Figure 12.2](#), for example, color adds emphasis to different kinds of information.
- **Use color to create patterns.** The principle of repetition — readers learn to recognize patterns — applies in graphics as well as in document design. In creating patterns, also consider shape. For instance, use red for safety comments but place them in octagons resembling a stop sign. This way, you give your readers two visual cues to help them recognize the pattern. [Figure 12.3](#) (on [page 302](#)) shows the use of color to establish patterns. Color is also an effective way to emphasize design features such as text boxes, rules, screens, and headers and footers.

For more about designing your document, see [Ch. 11](#).

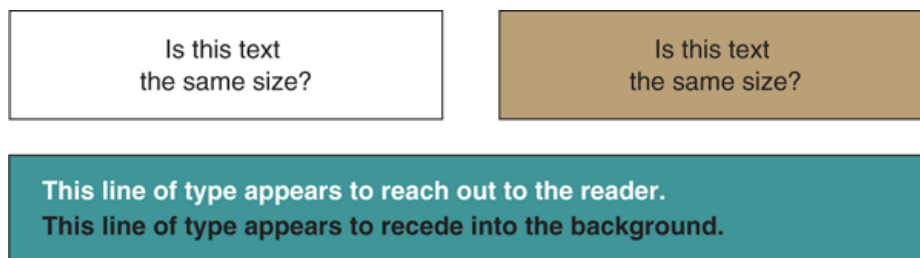
- **Use contrast effectively.** The visibility of a color is a function of the background against which it appears (see [Figure 12.4](#) on [page 302](#)). The strongest contrasts are between black and white and between black and yellow. The need for effective contrast also applies to graphics used in presentations, as shown in [Figure 12.5](#) on [page 302](#).

For more about presentation graphics, see [Ch. 21, p. 586](#).

- **Take advantage of any symbolic meanings colors may already have.** In American culture, for example, red signals danger, heat, or electricity; yellow signals caution; and orange signals warning. Using these warm colors in ways that depart from these familiar meanings could be confusing. The cooler colors — blues and greens — are more conservative and subtle. ([Figure 12.6](#) illustrates these principles.) Keep in mind, however, that people in different cultures interpret colors differently.

For more about cultural patterns, see [Ch. 5, p. 96](#).

- **Be aware that color can obscure or swallow up text.**



If you are using print against a colored background, you might need to make the type a little bigger, because color makes text look smaller.

Text printed against a white background looks bigger than the same-size text printed against a colored background. White letters counteract this effect.

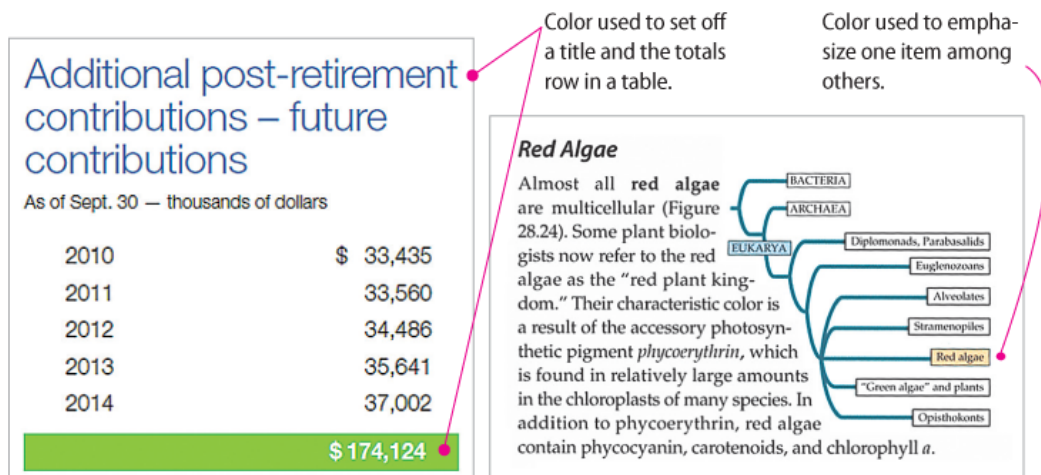


Figure 12.2

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(Left) Information from *Bonneville*, 2009: [www.bpa.gov/Financial Information/Annual reports/Documents/AR2009.pdf](http://www.bpa.gov/Financial%20Information/Annual%20reports/Documents/AR2009.pdf)
(Right) LIFE: THE SCIENCE OF BIOLOGY 7E edited by W. K. Purves, D. Sadava, G. H. Orians, and H. C. Heller (2004): Figure: 'Red Algae' (p. 560). By permission of Oxford University Press USA.

FIGURE 12.2 Color Used for Emphasis

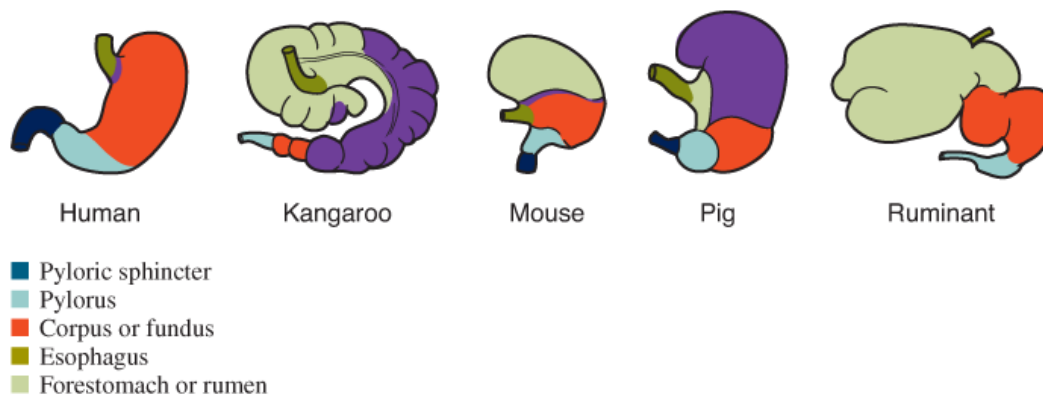


Figure 12.3

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FIGURE 12.3 Color Used to Establish Patterns

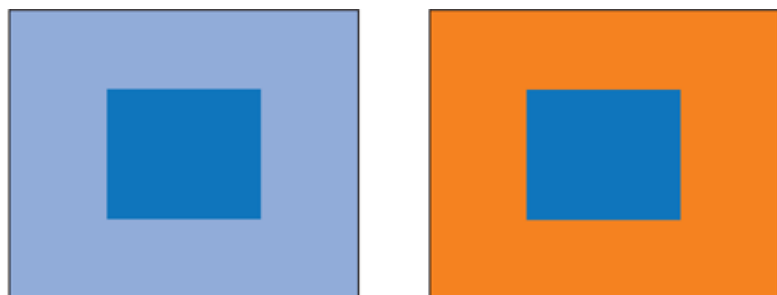


Figure 12.4

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American Association for the Advancement of Science (AAAS). AAAS Report XXXVI. Research and Development FY 2013. Reprinted with permission from AAAS.

FIGURE 12.4 The Effect of Background in Creating Contrast

In graphic (a), the text is hard to read because of insufficient contrast. The greater contrast in graphic (b) makes the text easier to read.



a. Insufficient contrast

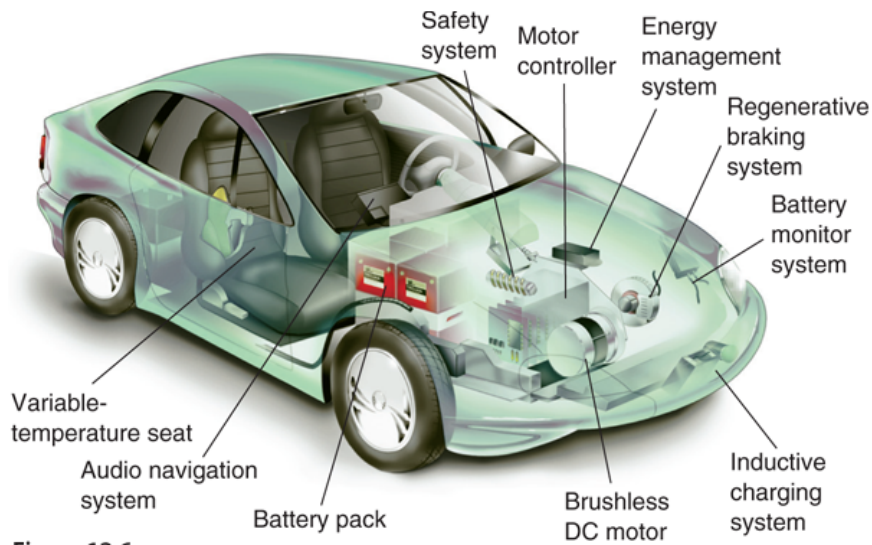


b. Effective contrast

Figure 12.5

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FIGURE 12.5 Effective Contrast Used in a Presentation Slide



The batteries are red. The warm red contrasts effectively with the cool green of the car body.

Figure 12.6

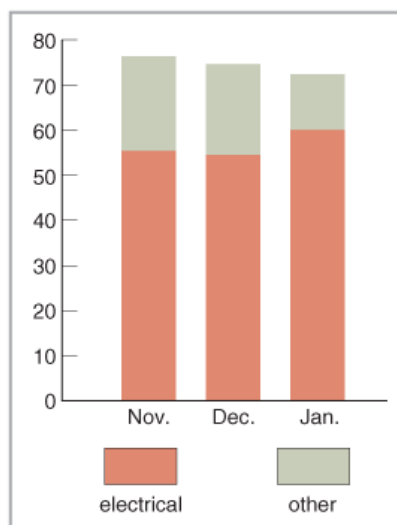
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FIGURE 12.6 Colors Have Clear Associations for Readers

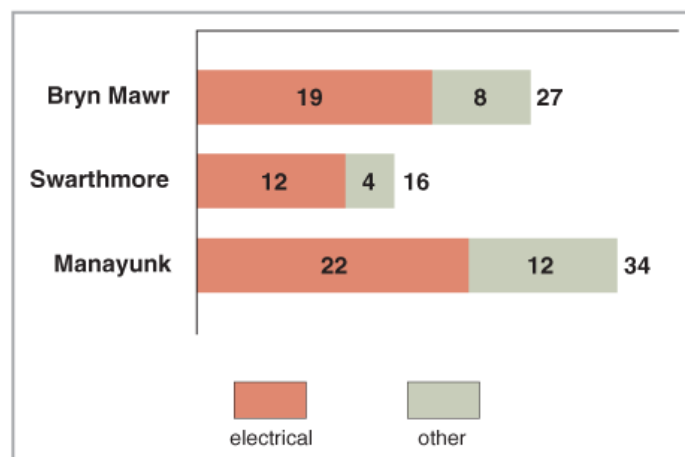
Choosing the Appropriate Kind of Graphic

As [Figure 12.7](#) (on [page 304](#)) shows, even a few simple facts can yield a number of different points. Your responsibility when creating a graphic is to determine what point you want to make and how best to make it. Don't rely on your software to do your thinking; it can't.

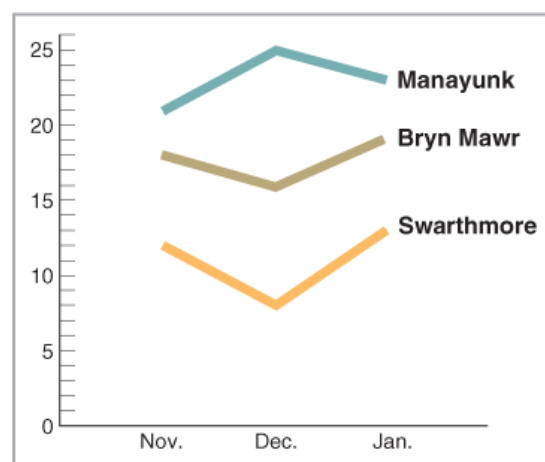
Rail Line	November		December		January	
	Disabled by electrical problems (%)	Total disabled	Disabled by electrical problems (%)	Total disabled	Disabled by electrical problems (%)	Total disabled
Bryn Mawr	19 (70)	27	17 (60)	28	20 (76)	26
Swarthmore	12 (75)	16	9 (52)	17	13 (81)	16
Manayunk	22 (64)	34	26 (83)	31	24 (72)	33



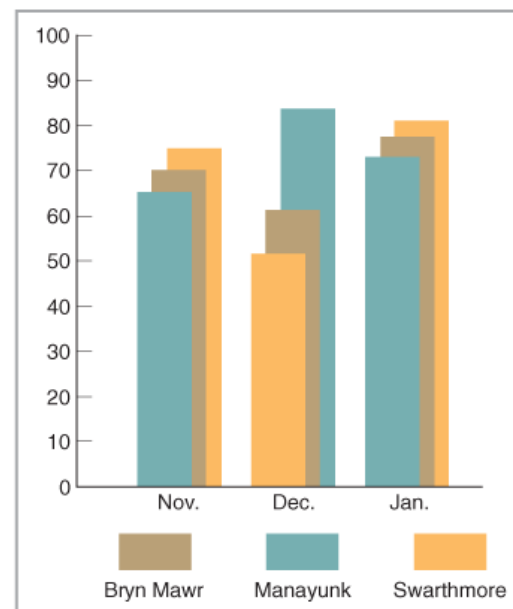
a. Number of railcars disabled, November–January



b. Number of railcars disabled in November



c. Number of railcars disabled by electrical problems, November–January



d. Range in percentage of railcars, by line, disabled by electrical problems, November–January

Figure 12.7

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.7 Different Graphics Emphasizing Different Points

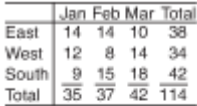
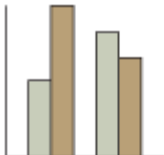
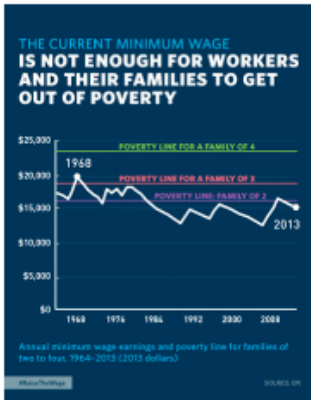
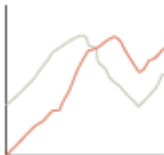
Each of these four graphs emphasizes a different point derived from the data in the table. Graph (a) focuses on the total number of railcars disabled each month, classified by cause; graph (b) focuses on the three rail lines during one month; and so forth. For information on bar graphs, see [pages 309–14](#); for information on line graphs, see [pages 316–18](#).

Graphics used in technical documents are classified as tables or figures. Tables are lists of data, usually numbers, arranged in columns. Figures are everything else: graphs, charts, diagrams, photographs, and the

like. Typically, tables and figures are numbered separately: the first table in a document is Table 1; the first figure is Figure 1. In documents of more than one chapter (like this book), the graphics are usually numbered within each chapter. That is, Figure 3.2 is the second figure in [Chapter 3](#).

The discussion that follows is based on the classification system in William Horton's "Pictures Please — Presenting Information Visually," in *Techniques for Technical Communicators* ([Horton, 1992](#)). [Table 12.1](#) on pages 305–06 presents an overview of the discussion that begins on [page 307](#).

TABLE 12.1 Choosing the Appropriate Kind of Graphic

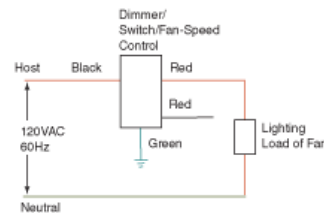
PURPOSE	TYPE OF GRAPHIC	WHAT THE GRAPHIC DOES BEST
Illustrating numerical information	Table  Markel/Selber, <i>Technical Communication</i>, 12e, © 2018 Bedford/St. Martin's	Shows large amounts of numerical data, especially when there are several variables for a number of items
	Bar graph  Markel/Selber, <i>Technical Communication</i>, 12e, © 2018 Bedford/St. Martin's	Shows the relative values of two or more items.
	Infographic  Markel/Selber, <i>Technical Communication</i>, 12e, © 2018 Bedford/St. Martin's	Enlivens statistical information for the general reader.
	Line graph  Markel/Selber, <i>Technical Communication</i>, 12e, © 2018 Bedford/St. Martin's	Shows how the quantity of an item changes over time. A line graph can present much more data than a bar graph can.
	Pie chart	Shows the relative sizes of the parts of a whole. Pie charts are instantly familiar to most readers.



Markel/Selber,
Technical
Communication,
12e, © 2018
Bedford/
St. Martin's

Illustrating logical
relationships

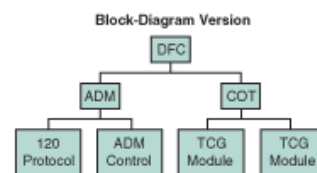
Diagram



Markel/Selber, *Technical
Communication*, 12e, ©
2018 Bedford/ St. Martin's

Represents relationships
among items or
properties of items.

Organization chart

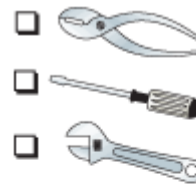


Markel/Selber, *Technical
Communication*, 12e, ©
2018 Bedford/ St. Martin's

Shows the lines of
authority and
responsibility in an
organization or
hierarchical relationships
among items.

Illustrating process
descriptions and
instructions

Checklist



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Technical
Communication,
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St. Martin's

Lists or shows what
equipment or materials to
gather or describes an
action.

Table

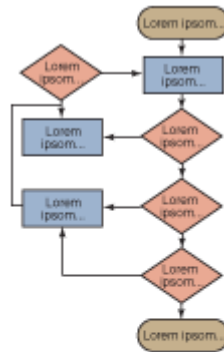
	Light Use			
PM (Months)	3	6	9	12
Clean Exterior/Interior	☐	☐	☐	☐
Clean Heads	☐	☐	☐	☐
Lubricate Transport	☐	☐	☐	☐
Clean Rubber Parts	☐	☐	☐	☐
Clean Battery	☐	☐	☐	☐
Clean Connectors	☐	☐	☐	☐

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Technical
Communication,
12e, © 2018
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St. Martin's

Shows numbers of items
or indicates the state
(on/off) of an item.

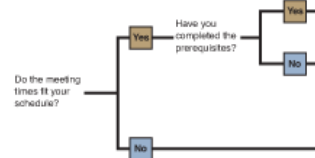
Flowchart

Shows the stages of a
procedure or a process.



Markel/Selber,
*Technical
 Communication,*
 12e, © 2018
 Bedford/
 St. Martin's

Logic tree



Shows which of two or more paths to follow.

Markel/Selber, *Technical
 Communication,* 12e, © 2018
 Bedford/St. Martin's

Illustrating visual and spatial characteristics

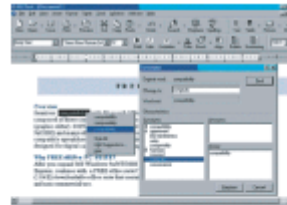
Photograph



Shows precisely the external surface of objects.

Markel/Selber, *Technical
 Communication,* 12e, ©
 2018 Bedford/St. Martin's

Screen shot



Shows what appears on a computer screen.

Markel/Selber,
*Technical
 Communication,*
 12e, © 2018
 Bedford/
 St. Martin's

Line drawing



Shows simplified representations of objects.

Markel/Selber, *Technical
 Communication,* 12e, ©
 2018 Bedford/St. Martin's

Map

Shows geographic areas.



Markel/Selber,
Technical
Communication,
12e, © 2018
Bedford/
St. Martin's

Information from W. Horton, "The Almost Universal Language: Graphics for International Documentation" from TECHNICAL COMMUNICATION 40 (1993): 682–693.

ILLUSTRATING NUMERICAL INFORMATION

The kinds of graphics used most often to display numerical values are tables, bar graphs, infographics, line graphs, and pie charts.

Tables *Tables* convey large amounts of numerical data easily, and they are often the only way to present several variables for a number of items. For example, if you wanted to show how many people are employed in six industries in 10 states, a table would probably be most effective. Although tables lack the visual appeal of other kinds of graphics, they can present much more information.

In addition to having a number ("Table 1"), tables are identified by an informative title that includes the items being compared and the basis (or bases) of comparison:

Table 3. Mallard Population in Rangeley, 2009–2016

Table 4.7. The Growth of the Robotics Industry in Japan and the United States, 2016

[Figure 12.8](#) illustrates the standard parts of a table.

Tables are usually titled at the top because readers scan them from top to bottom.

The data in this table consist of numbers, but tables can also present textual information or a combination of numbers and text.

Natural Gas Plant Stocks (Thousand Barrels)

Area: U.S. Period: Monthly

 Download Series History		 Definitions, Sources & Notes							
Show Data By:		Graph							View History
☒ Product	☐ Area	Clear	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	
Natural Gas Liquids		☐	5,047	4,828	4,550	4,787	5,625	5,419	1993-2013
Pentanes Plus		☐	492	383	462	553	675	787	1993-2013
Liquefied Petroleum Gases		☐	4,555	4,445	4,088	4,234	4,950	4,632	1993-2013
Ethane		☐	672	837	871	812	1,212	822	1993-2013
Propane		☐	1,998	1,944	1,655	1,702	2,126	2,098	1993-2013
Normal Butane		☐	1,207	907	864	830	757	936	1993-2013
Isobutane		☐	678	757	698	890	855	776	1993-2013

- = No Data Reported; -- = Not Applicable; NA = Not Available; W = Withheld to avoid disclosure of individual company data.

Notes: See Definitions, Sources, and Notes link above for more information on this table.

Release Date: 6/27/2013

Next Release Date: Last Week of July 2013

Some tables include a stub head. The stub — the left-hand column — lists the items for which data are displayed. Note that indentation in the stub helps show relationships. The heading "Natural Gas Liquids" is left-aligned. This row functions as a Totals row. Indented beneath this heading are the two categories that make up the totals: pentanes plus and liquefied petroleum gases. Beneath the category heading are rows for the four kinds of liquefied petroleum gases.

Note that the numbers are right-aligned.

Note that tables often contain one or more source statements and footnotes.

Figure 12.8

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

Information from U.S. Energy Information Administration, 2013:

www.eia.gov/dnav/pet/pet_stoc_gp_dcu_nus_m.htm.

FIGURE 12.8 Parts of a Table

This is an interactive table from the Energy Information Administration showing the amount of natural gas stocks in the United States over a six-month period. Note that you can use the radio buttons to show the data by location or product, and you can use

the pull-down menu to specify a time frame. Even though this table is interactive, it functions much the way any table does.

GUIDELINES: Creating Effective Tables

Follow these nine suggestions to make sure your tables are clear and professional.

- **Indicate the units of measure.** If all the data are expressed in the same unit, indicate that unit in the title:

Farm Size in the Midwestern States (in Hectares)

If the data in different columns are expressed in different units, indicate the units in the column heads:

Population (in Millions)	Per Capita Income (in Thousands of U.S. Dollars)
-----------------------------	---

You can express data in both real numbers and percentages. A column head and the first data cell under it might read as follows:

Number of Students (Percentage)
53 (83)

- **In the stub — the left-hand column — list the items being compared.** Arrange the items in a logical order: big to small, more important to less important, alphabetical, chronological, geographical, and so forth. If the items fall into several categories, include the names of the categories in the stub:

Snowbelt States
Connecticut
New York
Vermont
Sunbelt States
Arizona
California
New Mexico

If you cannot group the items in the stub in logical categories, skip a line after every five rows to help the reader follow the rows across the table. Or use a screen (a colored background) for every other set of five rows. Also useful is linking the stub and the next column with a row of dots called *dot leaders*.

For more about screens, see Ch. 11, [p. 273](#).

- **In the columns, arrange the data clearly and logically.** Use the decimal-tab feature to line up the decimal points:

3,147.4
365.7
46,803.5

In general, don't vary the units used in a column unless the quantities are so dissimilar that your readers would have a difficult time understanding them if expressed in the same units.

3.4 hr
12.7 min
4.3 sec

This list would probably be easier for most readers to understand than one in which all quantities were expressed in the same unit.

- **Do the math.** If your readers will need to know the totals for the columns or the rows, provide them. If your readers will need to know percentage changes from one column to the next, present them:

Number of Students (Percentage Change from Previous Year)

2013	2014	2015
619	644 (+4.0)	614 (−4.7)

- **Use dot leaders if a column contains a “blank” spot** — a place where there are no appropriate data:

3,147
...
46,803

But don't substitute dot leaders for a quantity of zero.

- **Don't make the table wider than it needs to be.** The reader should be able to scan across a row easily. As [White \(1984\)](#) points out, there is no reason to make a table as wide as the text column in the document. If a

column head is long — more than five or six words — stack the words:

Computers Sold Without
a Memory-Card Reader

- ▶ **Minimize the use of rules.** [Grimstead \(1987\)](#) recommends using rules only when necessary: to separate the title and the heads, the heads and the body, and the body and the notes. When you use rules, make them thin rather than thick.
- ▶ **Provide footnotes where necessary.** All the information your readers need in order to understand the table should accompany it.
- ▶ **If you did not generate the information yourself, indicate your source.** See the discussion of citing sources of graphics on [page 300](#).

Bar Graphs Like tables, *bar graphs* can communicate numerical values, but they are better at showing the relative values of two or more items. [Figure 12.9](#) on page 310 shows typical horizontal and vertical bar graphs that you can make easily using your spreadsheet software. [Figure 12.10](#) on page 310 shows an effective bar graph that uses grid lines.

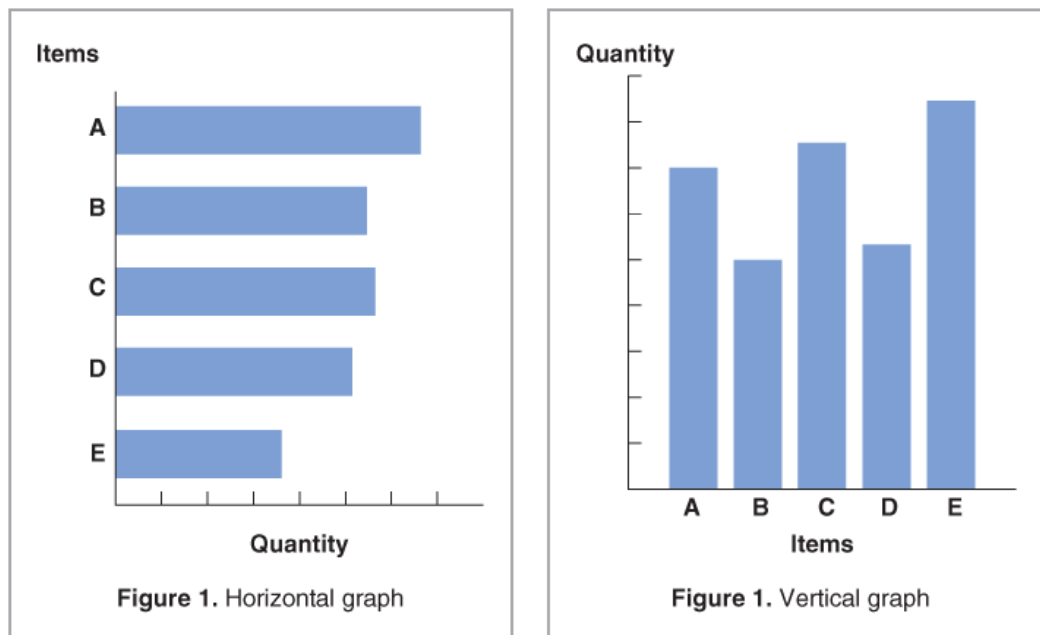


Figure 12.9

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.9 Structures of Horizontal and Vertical Bar Graphs

Horizontal bars are best for showing quantities such as speed and distance. Vertical bars are best for showing quantities such as height, size, and amount. However, these distinctions are not ironclad; as long as the axes are clearly labeled, readers should have no trouble understanding the graph.

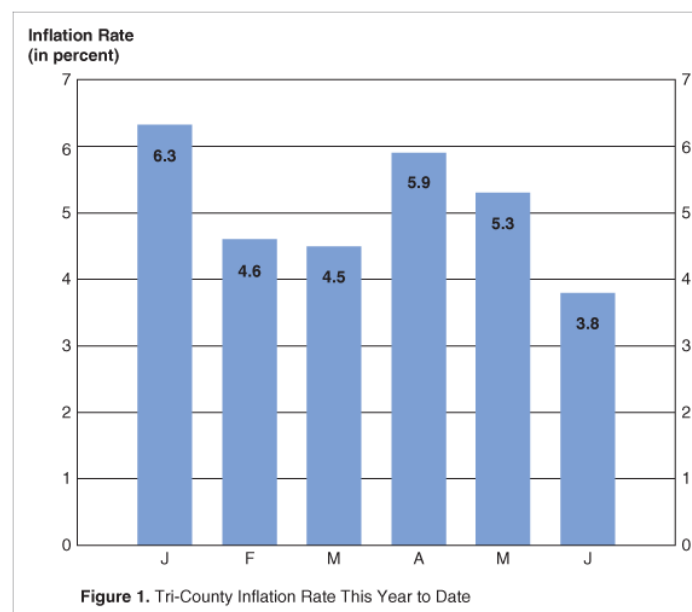


Figure 12.10

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.10 Effective Bar Graph with Grid Lines

TECH TIP

Why To Create Tables, Charts, and Other Graphics

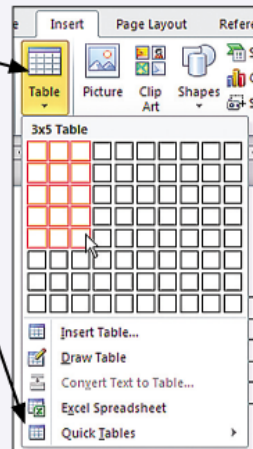
As noted throughout this chapter, displaying information visually is often more economical than writing it out, and material is easier for readers to understand and remember when it is displayed visually than when it is presented using only words. If you have a data set or other information you want to display visually, you can use a variety of tools to create tables, graphs, charts, and other graphics. Be careful, however, not to go overboard with elaborate graphics. Keep your audience and purpose in mind, and make your message as clear as possible.

How To Create Tables, Charts, and Other Graphics

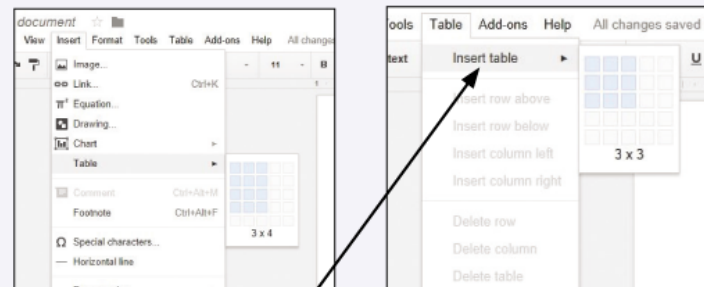
To create tables in Microsoft Word or Google Docs, choose **Table** from the **Insert** tab. Both programs allow you to create a table by dragging your cursor to specify the numbers of columns and rows.

Microsoft Word

Word offers additional options, such as using the **Insert Table** dialog box to specify the numbers of columns and rows, converting text into a table, importing data from Excel, or selecting a **Quick Tables** template and replacing the data with your own.



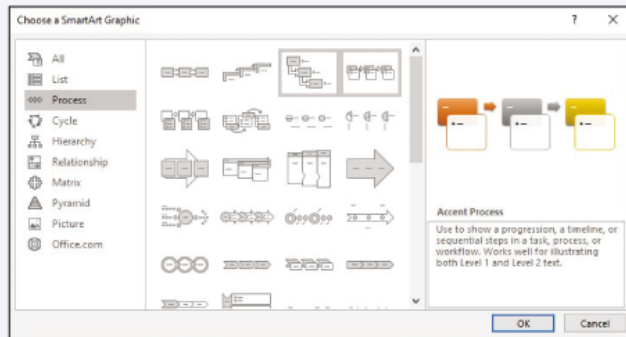
Google Docs



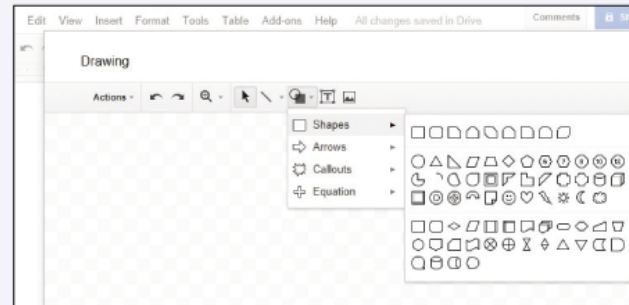
Another way to insert a table in Google Docs is to choose the **Insert Table** feature from the **Table** tab.

Both Google Docs and Microsoft Word include **Drawing** tools in the **Insert** tab that allow you to insert shapes into your document, many of which can incorporate text. In addition, Word's **Smart Art** feature provides an elaborate array of customizable graphics that are organized by category, such as List, Process, and Cycle.

Smart Art in Microsoft Word

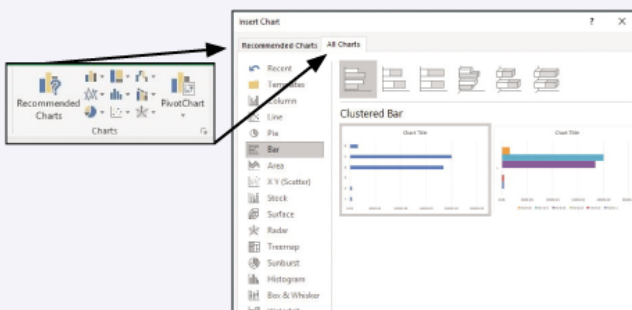


Drawing Shapes in Google Docs

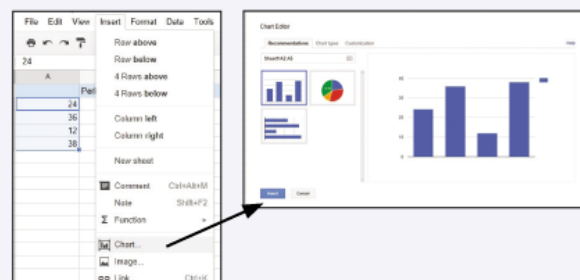


To create charts in Microsoft Excel or Google Spreadsheets, first enter the data into the spreadsheet and select the cells you want to include in your graphic. In Excel, use the drop-down menus in the **Charts** group on the **Insert** tab, or select **See All Charts** in the lower right to open the **Chart** dialog box. In Google, select **Chart** from the **Insert** tab to launch the chart selection dialog box. Both programs allow you to choose from a wide range of graphics, but simpler is usually better.

Microsoft Excel

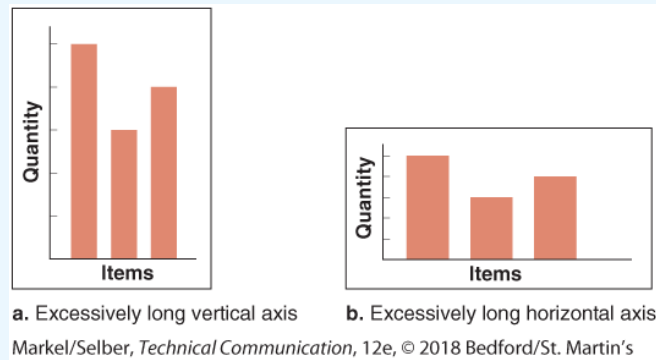


Google Spreadsheets

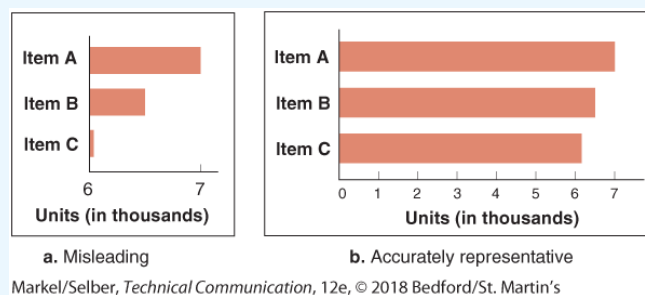


GUIDELINES: Creating Effective Bar Graphs

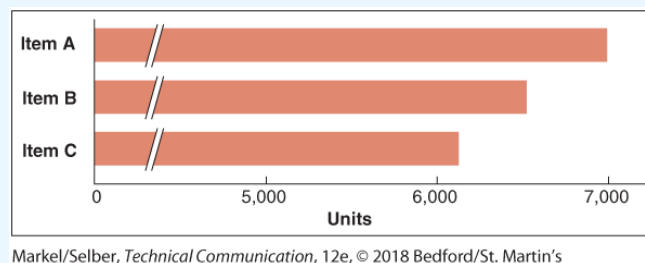
- ▶ **Make the proportions fair.** Make your vertical axis about 25 percent shorter than your horizontal axis. An excessively long vertical axis exaggerates the differences in quantities; an excessively long horizontal axis minimizes the differences. Make all the bars the same width, and make the space between them about half as wide as a bar. Here are two poorly proportioned graphs:



- ▶ **If possible, begin the quantity scale at zero.** Doing so ensures that the bars accurately represent the quantities. Notice how misleading a graph can be if the scale doesn't begin at zero.



If it is not practical to start the quantity scale at zero, break the quantity axis clearly at a common point on all the bars.

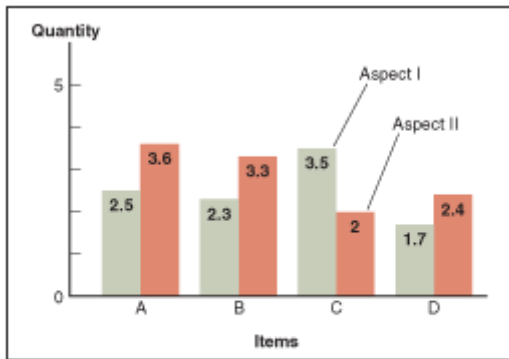


- ▶ **Use tick marks — marks along the axis — to signal the amounts.** Use grid lines — tick marks that extend across the entire graph — if the graph has several bars, some of which are too far away from the tick marks to enable readers to gauge the quantities easily. (See [Figure 12.10](#) on p. 310.)
- ▶ **Arrange the bars in a logical sequence.** For a vertical bar graph, use chronology if possible. For a horizontal bar graph, arrange the bars in order of descending size, beginning at the top of the graph, unless some other logical sequence seems more appropriate.
- ▶ **Place the title below the figure.** Unlike tables, which are usually read from top to bottom, figures are usually read from the bottom up.
- ▶ **Indicate the source of your information if you did not generate it yourself.**

The five variations on the basic bar graph shown in [Table 12.2](#) can help you accommodate different communication needs. You can make all these types using your spreadsheet software.

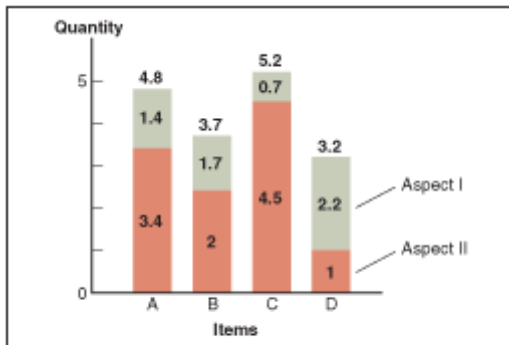
TABLE 12.2 Variations on the Basic Bar Graph

Grouped bar graph. The *grouped bar graph* lets you compare two or three aspects for each item. Grouped bar graphs would be useful, for example, for showing the numbers of full-time and part-time students at several universities. One bar could represent full-



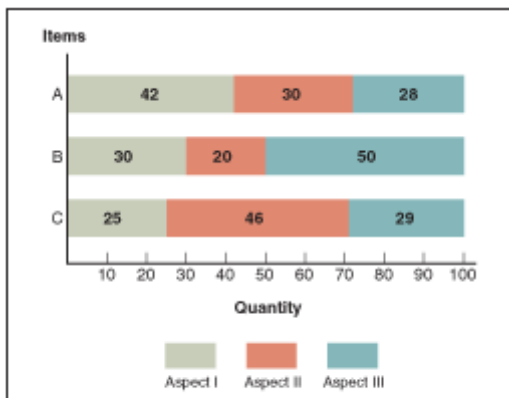
Markel/Selber, *Technical Communication*, 12e,
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time students; the other, part-time students. To distinguish between the bars, use hatching (striping), shading, or color, and either label one set of bars or provide a key.



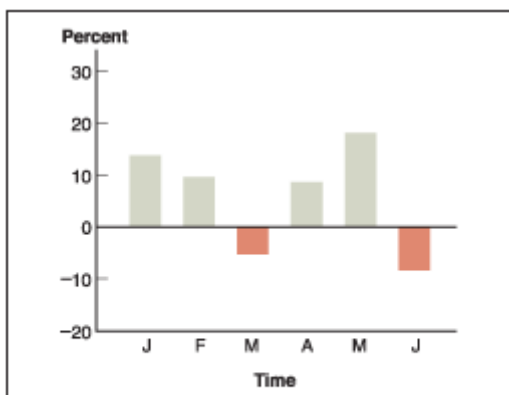
Markel/Selber, *Technical Communication*, 12e,
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Subdivided bar graph. In the *subdivided bar graph*, Aspect I and Aspect II are stacked like wooden blocks placed on top of each other. Although totals are easy to compare in a subdivided bar graph, individual quantities are not.



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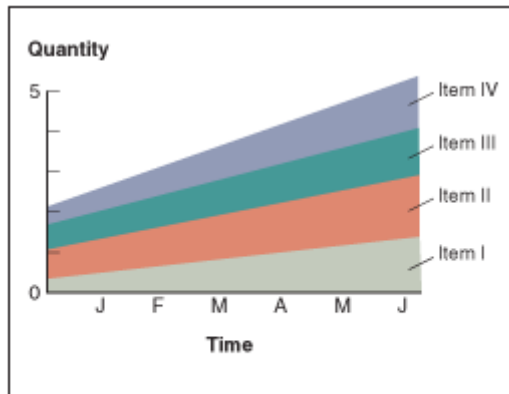
100-percent bar graph. The *100-percent bar graph*, which shows the relative proportions of the aspects that make up several items, is useful in portraying, for example, the proportion of full-scholarship, partial-scholarship, and non-scholarship students at a number of colleges.



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Deviation bar graph. The *deviation bar graph* shows how various quantities deviate from a norm. Deviation bar graphs are often used when the information contains both positive and negative values, such as profits and losses. Bars on the positive side of the norm line (above it) represent profits; bars on the negative side (below it), losses.

Stratum graph. The *stratum graph*, also called an *area graph*, shows the change in quantities of several items over time. Although stratum graphs are used frequently in business and scientific fields, general readers sometimes have trouble understanding how to read them.



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Infographics An *infographic* — short for *information graphic* — is a combination of words and graphics used to present factual data about a subject in a visually interesting way.

GUIDELINES: Creating Effective Infographics

Follow these seven suggestions for making effective infographics.

- ▶ **Make a claim.** A good infographic states — or at least implies — a claim and then presents evidence to support it. For instance, the claim might be that the number of people accessing the Internet in a language other than English is increasing at an accelerating rate, that the pace at which new drugs are coming onto the market is slowing, or that the cost of waging a campaign for a U.S. Senate seat has increased tenfold in the last twenty years. The claim you present will suggest the theme of your graphics: you might consider maps, flowcharts, or statistics.

For more about claims and support, see Ch. 8, [p. 179](#).

- ▶ **Use accurate data.** Once you have settled on your claim, find facts to support it. Use reputable sources, and then check and re-check the facts. Be sure to cite your sources on the infographic itself.

For more about research techniques, see [Ch. 6](#).

- ▶ **Follow the guidelines for the type of graphic you are creating.** Although you want to express your creativity when you create graphics, abide by the guidelines for that type of graphic. For instance, if you use a bar graph to present data on the number of zebras born in captivity, your first obligation is to make the length of each bar reflect the quantity it represents; don't manipulate the lengths of the bars to make the graph look like a zebra.

- ▶ **Write concisely.** If you need more than a paragraph to introduce a graphic, try revising the text to get the word count down or see if you can break the idea into several smaller ones.

- ▶ **Don't present too much information.** It's natural to want to include all the data you have found, but if the infographic is too tightly packed with text and graphics, readers will be intimidated. Use white space to let the graphics breathe.

- ▶ **Don't go on forever.** Your readers will want to spend a minute — maybe two — on the infographic. They won't want to spend 15 minutes.

- ▶ **Test the infographic.** As with any kind of technical document, the more you evaluate and test the infographic, the better it will be.

For more about evaluating and testing, see [Ch. 13](#).

[Figure 12.11](#) (on [page 316](#)), a portion of an infographic about infographics, shows many of the techniques used in this type of display.

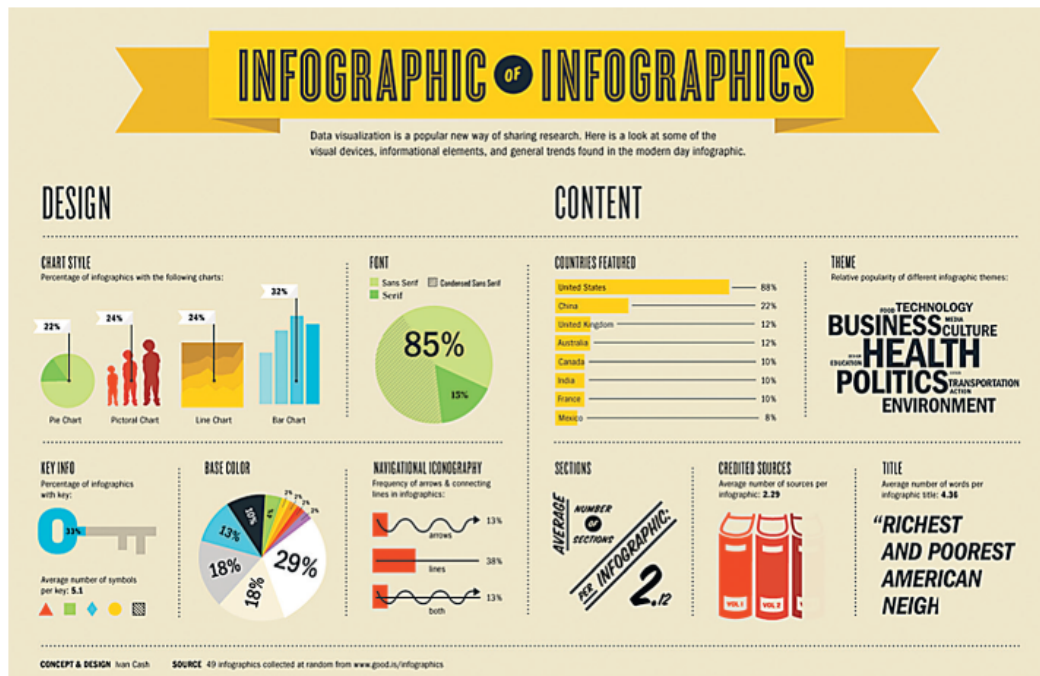


Figure 12.11
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Used by permission of Ivan Cash/Cash Studios.

FIGURE 12.11 An Infographic About Infographics

Designer Ivan Cash created this infographic by collecting data about infographics and then creating graphics to make the data interesting and visually appealing.

Infographics are built around basic types of graphical display: pie charts, line graphs, bar graphs, and diagrams. In an effective infographic, each visual display adheres to the conventions of the graphic on which it is based. For instance, in the "Countries Featured" bar graph, the length of each bar accurately reflects the quantity of the item it represents.

The art makes the data visually interesting, but the most important characteristic of an infographic is accuracy: the data must be accurate and presented fairly.

Infographics are also an effective way to communicate information through a visual/verbal argument. [Figure 12.12](#) (on [page 317](#)) shows a portion of an infographic that makes a very clear argument about the rising size of food portions.

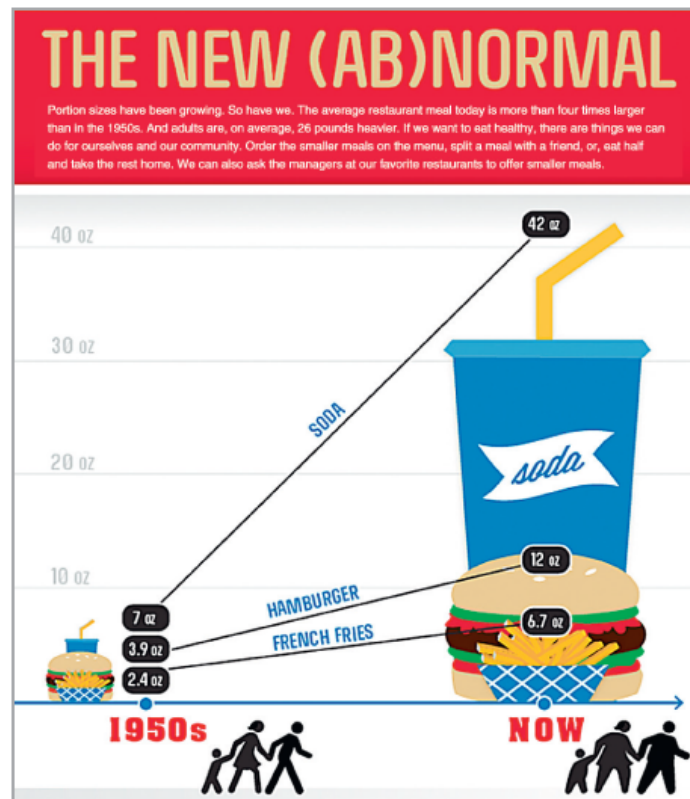


Figure 12.12
 Markel/Selber, *Technical Communication*, 12e,
 © 2018 Bedford/St. Martin's
 Information from Centers for Disease Control, 2012:
<http://makinghealtheasier.org/newabnormal/>.

FIGURE 12.12 A Persuasive Infographic

Many organizations use infographics to present arguments. Here, the Centers for Disease Control and Prevention compares fast-food portion sizes from the 1950s and today to make the case that, as the text at the top states, "Portion sizes have been growing. So have we." The text goes on to suggest steps people can take to reduce their portion sizes.

Several sites on the web, such as infogr.am, offer free templates for making infographics.

Infographics are very popular, but many of them are of low quality. Before you create an infographic to communicate technical information, be sure you are not skewing your data or oversimplifying to promote an agenda. Doing so is unethical. In [Figure 12.13](#) (on [page 317](#)), digital strategist Hervé Peitrequin offers a clever commentary on infographics.

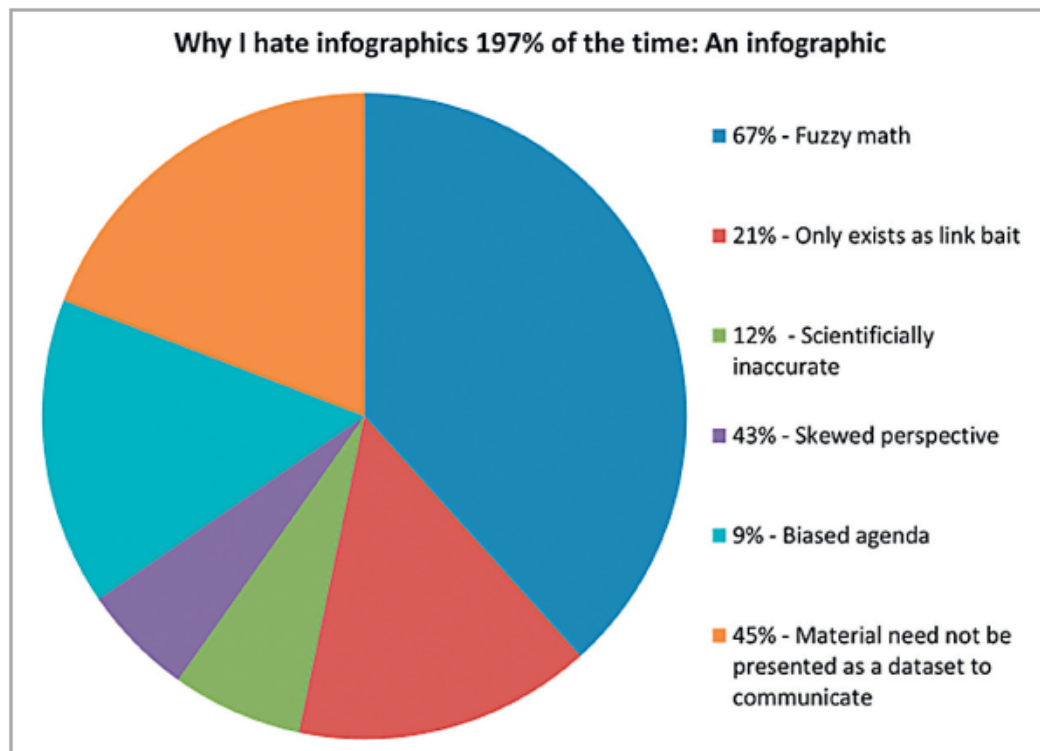


Figure 12.13

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.13 A Critique of Infographics

Line Graphs *Line graphs* are used almost exclusively to show changes in quantity over time: for example, the month-by-month production figures for a product. A line graph focuses readers' attention on the change in quantity, whereas a bar graph emphasizes the quantities themselves.

You can plot three or four lines on a line graph. If the lines intersect, use different colors or patterns to distinguish them. If the lines intersect too often, however, the graph will be unclear; in this case, draw separate graphs. [Figure 12.14](#) (on [page 318](#)) shows a line graph.

Note that the title is lengthy because it specifically names the main variables presented in the graph. Name all the important data in the title; it is better for a title to be lengthy than to be imprecise or unclear.

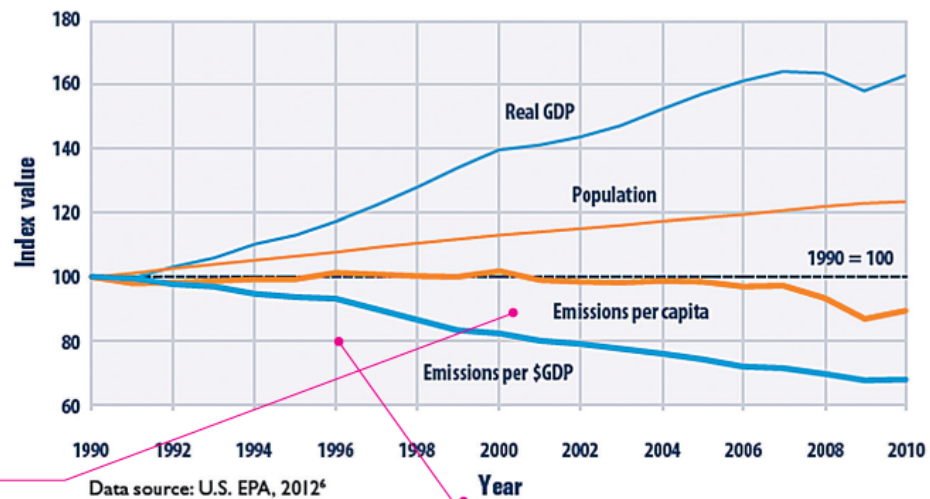
The designer has included a caption that explains how to read the graph. Because this graph is illustrating several items that are measured in different units and therefore cannot be plotted on the same scale (including population and greenhouse gases), the designer chose to have the y-axis express variations from a norm. In this case, the norm is represented by the quantity of each item in the year 1990. If this graph illustrated several items that were measured in the same units, such as the sales figures, in dollars, of several salespersons, the designer would start the y-axis at zero.

Because the four data lines are sufficiently far apart, the designer placed the appropriate data label next to each line. Alternatively, the designer could have used a separate color-coded legend.

Each axis is labeled clearly.

Figure 3. U.S. Greenhouse Gas Emissions per Capita and per Dollar of GDP, 1990–2010

This figure shows trends in greenhouse gas emissions from 1990 to 2010 per capita (heavy orange line), based on the total U.S. population (thin orange line). It also shows trends in emissions compared with the real GDP (heavy blue line). Real GDP is the value of all goods and services produced in the country during a given year, adjusted for inflation (thin blue line). All data are indexed to 1990 as the base year, which is assigned a value of 100. For instance, a real GDP value of 163 in the year 2010 would represent a 63 percent increase since 1990.



Using different colors and thicknesses for the lines helps readers distinguish them.

The grid lines — both vertical and horizontal — help readers see the specific quantity for any data point on the graph.

Figure 12.14

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from Environmental Protection Agency, 2012, p. 13:
<http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf>.

FIGURE 12.14 Line Graph

GUIDELINES: Creating Effective Line Graphs

Follow these three suggestions to create line graphs that are clear and easy to read.

- ▶ **If possible, begin the quantity scale at zero.** Doing so is the best way to portray the information honestly. If you cannot begin at zero, clearly indicate a break in the axis, if appropriate.
- ▶ **Use reasonable proportions for the vertical and horizontal axes.** As with bar graphs, make the vertical axis about 25 percent shorter than the horizontal axis.
- ▶ **Use grid lines — horizontal, vertical, or both — rather than tick marks when your readers need to read the quantities precisely.**

Pie Charts The *pie chart* is a simple but limited design used for showing the relative sizes of the parts of a whole. You can make pie charts with your spreadsheet software. [Figure 12.15](#) shows typical examples.

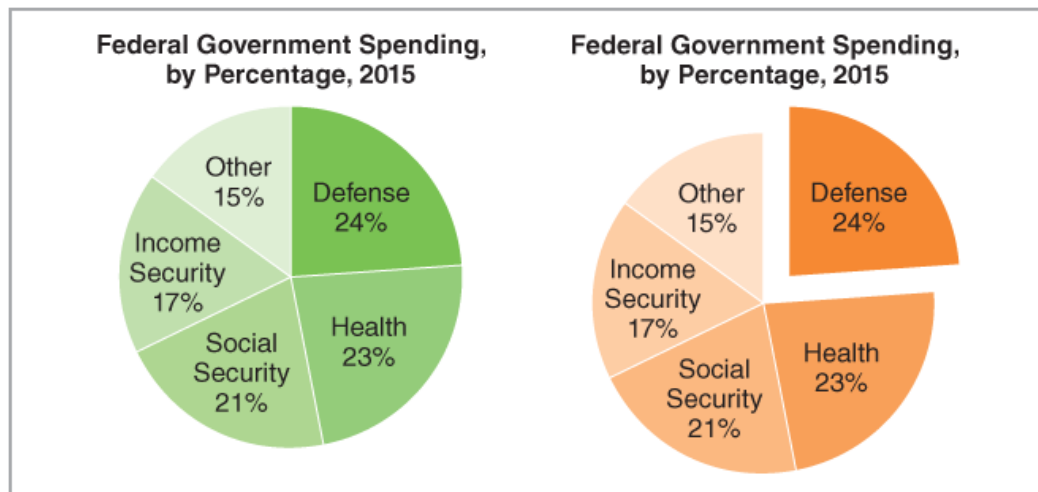


Figure 12.15
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.15 Pie Charts

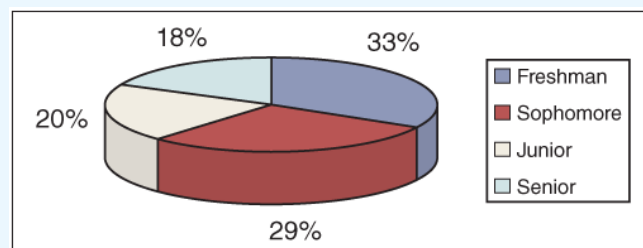
You can set your software so that the slices use different saturations of the same color. This approach makes the slices easy to distinguish from each other — without any distractions or misrepresentations caused by a rainbow of colors.

You can set your software to emphasize one slice by separating it from the rest of the pie.

GUIDELINES: Creating Effective Pie Charts

Follow these eight suggestions to ensure that your pie charts are easy to understand and professional looking.

- ▶ **Restrict the number of slices to no more than seven.** As the slices get smaller, judging their relative sizes becomes more difficult.
- ▶ **Begin with the largest slice at the top and work clockwise in order of decreasing size, unless you have a good reason to arrange the slices otherwise.**
- ▶ **If you have several very small quantities, put them together in one slice, to maintain clarity.** Explain its contents in a footnote. This slice, sometimes called “other,” follows the other slices.
- ▶ **Place a label (horizontally, not radially) inside the slice, if space permits.** Include the percentage that each slice represents and, if appropriate, the raw number.
- ▶ **To emphasize one slice, use a bright, contrasting color or separate the slice from the pie.** Do this, for example, when you introduce a discussion of the item represented by that slice.
- ▶ **Check to see that your software follows the appropriate guidelines for pie charts.** Some spreadsheet programs add fancy visual effects that can impair comprehension. For instance, many programs portray the pie in three dimensions, as shown here.



Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

In this three-dimensional pie chart about the percentages of a college's student body, by year, the sophomore slice looks bigger than the freshman slice, even though it isn't, because it appears closer to the reader. To communicate clearly, make pie charts two-dimensional.

- ▶ **Don't overdo fill patterns.** Fill patterns are patterns, shades, or colors that distinguish one slice from another. In general, use simple, understated patterns or none at all.
- ▶ **Check that your percentages add up to 100.** If you are doing the calculations yourself, check your math.

ILLUSTRATING LOGICAL RELATIONSHIPS

Graphics can help you present logical relationships among items. For instance, in describing a piece of

hardware, you might want to show its major components. The two kinds of graphics that best show logical relationships are diagrams and organization charts.

Diagrams A *diagram* is a visual metaphor that uses symbols to represent relationships among items or their properties. In technical communication, common kinds of diagrams are blueprints, wiring diagrams, and schematics. [Figure 12.16](#) is a diagram.

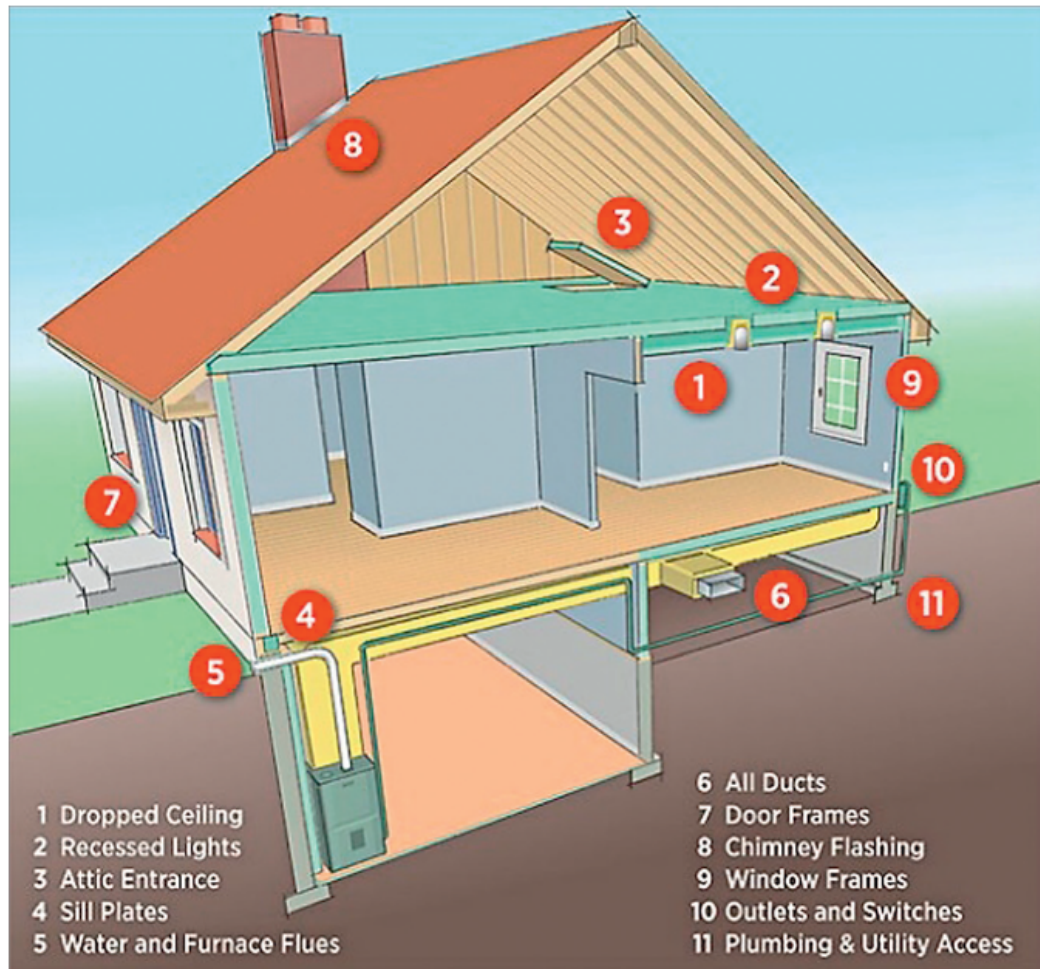


Figure 12.16
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Department of Energy, 2014:
<http://energy.gov/energysaver/articles/tips-sealing-air-leaks>.

FIGURE 12.16 Diagram

The purpose of this diagram is to help people understand the different areas in their home that need to be insulated. In diagrams, items do not necessarily look realistic. Here the designer is trying to represent logical relationships, not the physical appearances of items.

Organization Charts A popular form of diagram is the *organization chart*, in which simple geometric shapes, usually rectangles, suggest logical relationships, as shown in [Figure 12.17](#). You can create organization charts with your word processor.

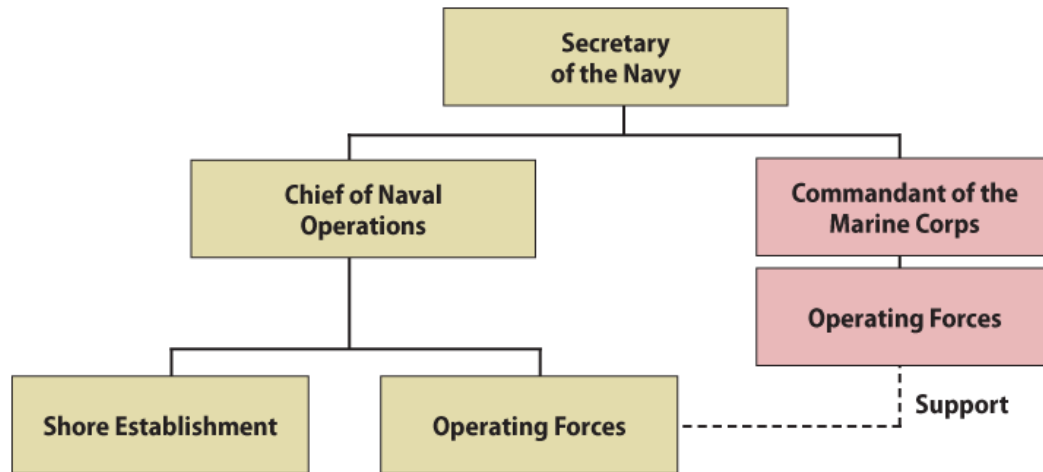


Figure 12.17
 Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
 Adapted from "US Navy Organization — An Overview," United States Department of the Navy:
<http://www.navy.mil/navydata/organization/org-over.asp>.

FIGURE 12.17 Organization Chart

An organization chart is often used to show the hierarchy in an organization, with the most senior person in the organization in the box at the top.

Alternatively, an organization chart can show the functional divisions of a system, such as the human nervous system.

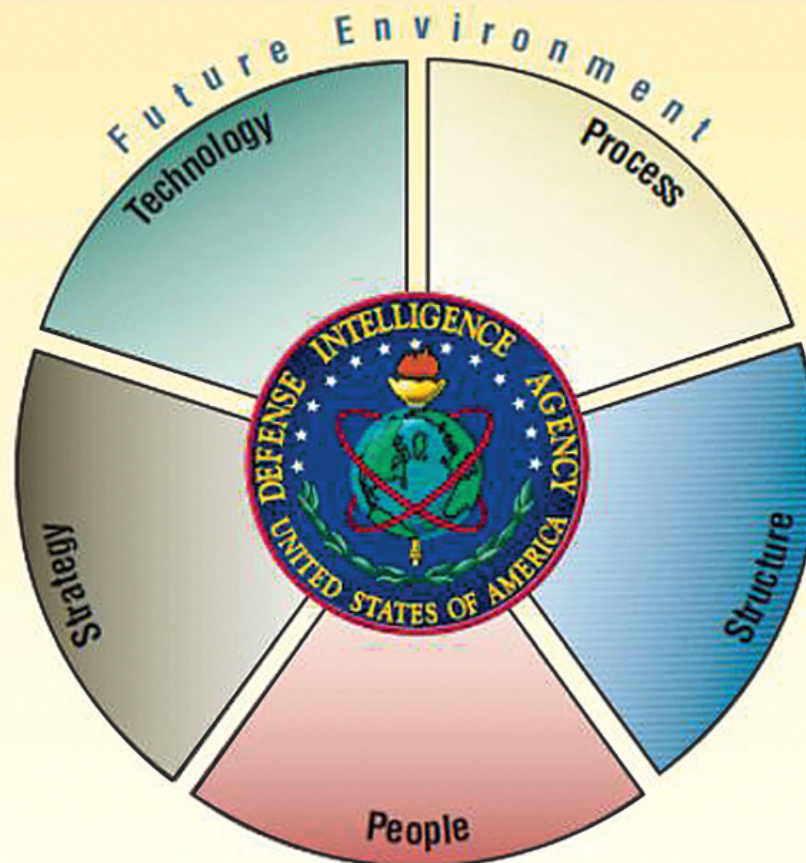
DOCUMENT ANALYSIS ACTIVITY

Analyzing a Graphic

This diagram is from a government report. The questions below ask you to think about diagrams, as discussed on [page 320](#).

1. This design resembles a pie chart, but it does not have the same function as a pie chart. What message does this design communicate? Is it effective?
2. Do the colors communicate any information, or are they merely decorative? If you think they are decorative, would you revise the design to change them in any way?
3. What does the phrase "Future Environment," above the graphic, mean? Is it meant to refer only to the "Technology" and "Process" shapes?
4. Is the explanation below the graphic clear? Would you change it in any way?

Context for Change



The graphic above illustrates the components of change that the Defense Intelligence Agency will consider as it embraces transformation. In the sections that follow, we discuss each component in turn, beginning with the Future Environment, progressing around the circle and ending with Recommendations.

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
 Information from Defense Intelligence Agency, 2003:
www.dia.mil/thisisdia/DIA_Workforce_of_the_Future.pdf.

DOCUMENT ANALYSIS ACTIVITY

To analyze a document that includes interactive graphics, go to LaunchPad.



Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
 "Hybrids Under the Hood (Part 2): Hybrid Drivetrain Animation" from Union of Concerned Scientists.
www.ucsusa.org. Reprinted by Permission.

ILLUSTRATING PROCESS DESCRIPTIONS AND INSTRUCTIONS

Graphics often accompany process descriptions and instructions (see [Chapter 20](#)). The following discussion looks at some of the graphics used in writing about actions: checklists, flowcharts, and logic trees. It also discusses techniques for showing motion in graphics.

Checklists In explaining how to carry out a task, you often need to show the reader what equipment or materials to gather, or describe an action or a series of actions to take. A *checklist* is a list of items, each preceded by a check box. If readers might be unfamiliar with the items you are listing, include drawings of the items, as shown in [Figure 12.18](#). You can use the list function in your word processor to create checklists.

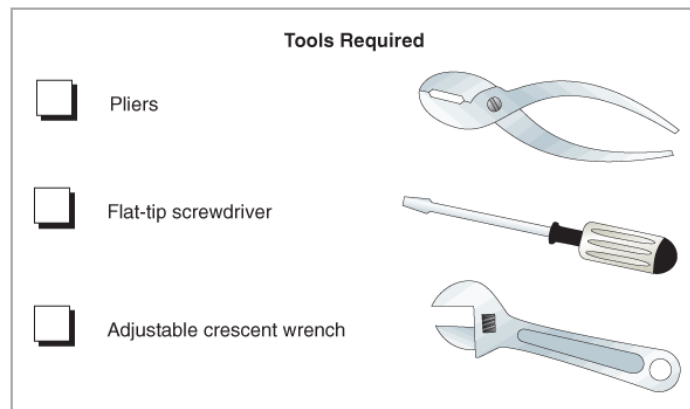


Figure 12.18
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.18 Checklist

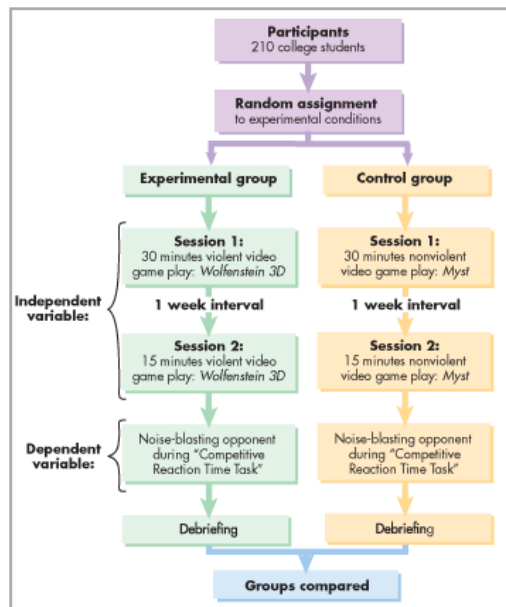
Often you need to indicate that readers are to carry out certain tasks at certain intervals. A table is a useful graphic for this kind of information, as shown in [Figure 12.19](#).

Regular Maintenance, First 40,000 Miles								
	Mileage							
	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000
Change oil, replace filter	✓	✓	✓	✓	✓	✓	✓	✓
Rotate tires	✓	✓	✓	✓	✓	✓	✓	✓
Replace air filter				✓				✓
Replace spark plugs				✓				✓
Replace coolant fluid								✓
Replace ignition cables								✓
Replace timing belt								✓

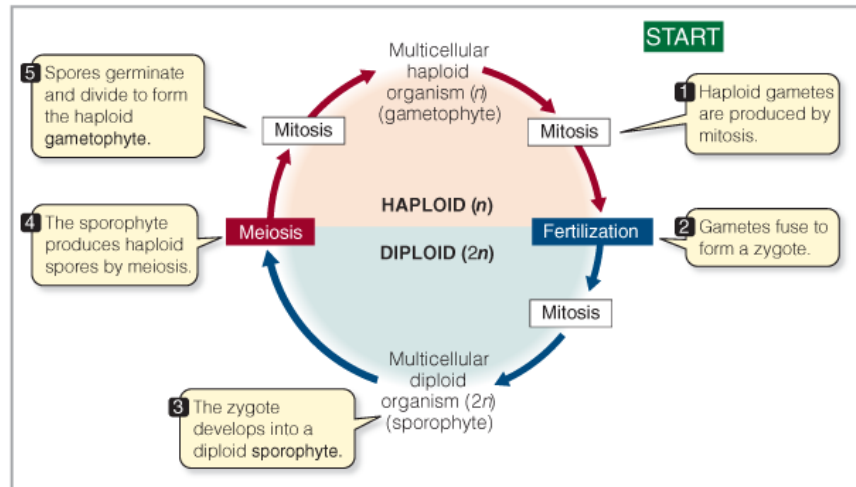
Figure 12.19
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.19 A Table Used To Illustrate a Maintenance Schedule

Flowcharts A *flowchart*, as the name suggests, shows the various stages of a process or a procedure. Flowcharts are useful, too, for summarizing instructions. On a basic flowchart, stages are represented by labeled geometric shapes. Flowcharts can portray open systems (those that have a start and a finish) or closed systems (those that end where they began). [Figure 12.20](#) shows an open-system flowchart and a closed-system flowchart. [Figure 12.21](#) shows a deployment flowchart, which you can make using the drawing tools in your word processor.



a. Open-system flowchart



b. Closed-system flowchart

Figure 12.20

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

(a) From Don Hockenbury and Sandra E. Hockenbury, *DISCOVERING PSYCHOLOGY*, Sixth Edition, Figure 1.3. Copyright ©2014. Used by permission of the publisher.

(b) From W. K. Purves, D. Sadava, G. H. Orians, and H. C. Heller, *LIFE: THE SCIENCE OF BIOLOGY*, Eighth Edition, Fig. 27.14, p. 594. Copyright ©2007. Reprinted by permission of Sinauer Associates.

FIGURE 12.20 Flowcharts

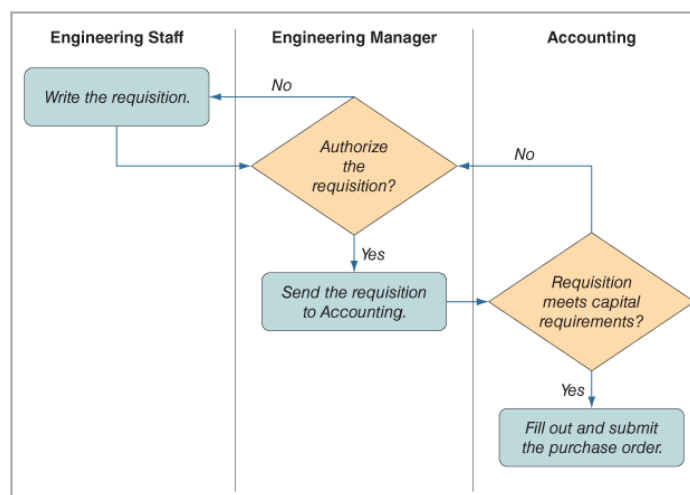


Figure 12.21

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.21 Deployment Flowchart

A deployment flowchart shows who is responsible for carrying out which tasks. Here the engineering staff writes the requisition, then sends it to the Engineering Manager.

Logic Trees Logic trees use a branching metaphor. The logic tree shown in [Figure 12.22](#) (on [page 326](#)) helps students think through the process of registering for a course.

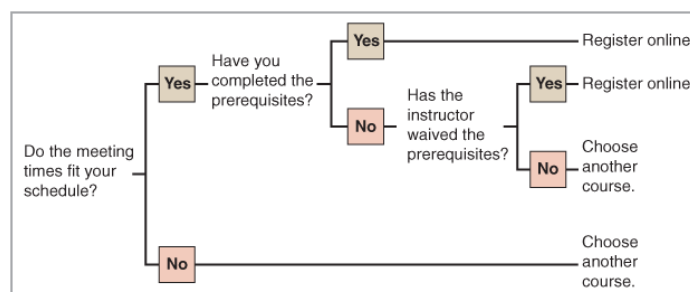


Figure 12.22

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.22 Logic Tree

Techniques for Showing Action or Motion In some types of process descriptions and instructions, you will want to show action or motion. For instance, in an instruction manual for helicopter technicians, you might want to illustrate the process of removing an oil dipstick or tightening a bolt, or you might want to show a warning light flashing. Although animation and video are frequently used to illustrate action or motion in online documents, such processes still need to be communicated in static graphics for print documents.

If the reader is to perform the action, show the action from the reader's point of view, as in [Figure 12.23](#).

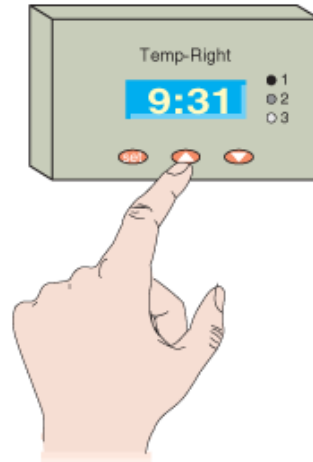


Figure 12.23
Markel/Selber, *Technical Communication*, 12e,
© 2018 Bedford/St. Martin's

FIGURE 12.23 Showing Action from the Reader's Perspective

In many cases, you need to show only the person's hands, not the whole body.

[Figure 12.24](#) illustrates four additional techniques for showing action. These techniques are conventional but not universal. If you are addressing readers from another culture, consult a qualified person from that culture to make sure your symbols are clear and inoffensive.

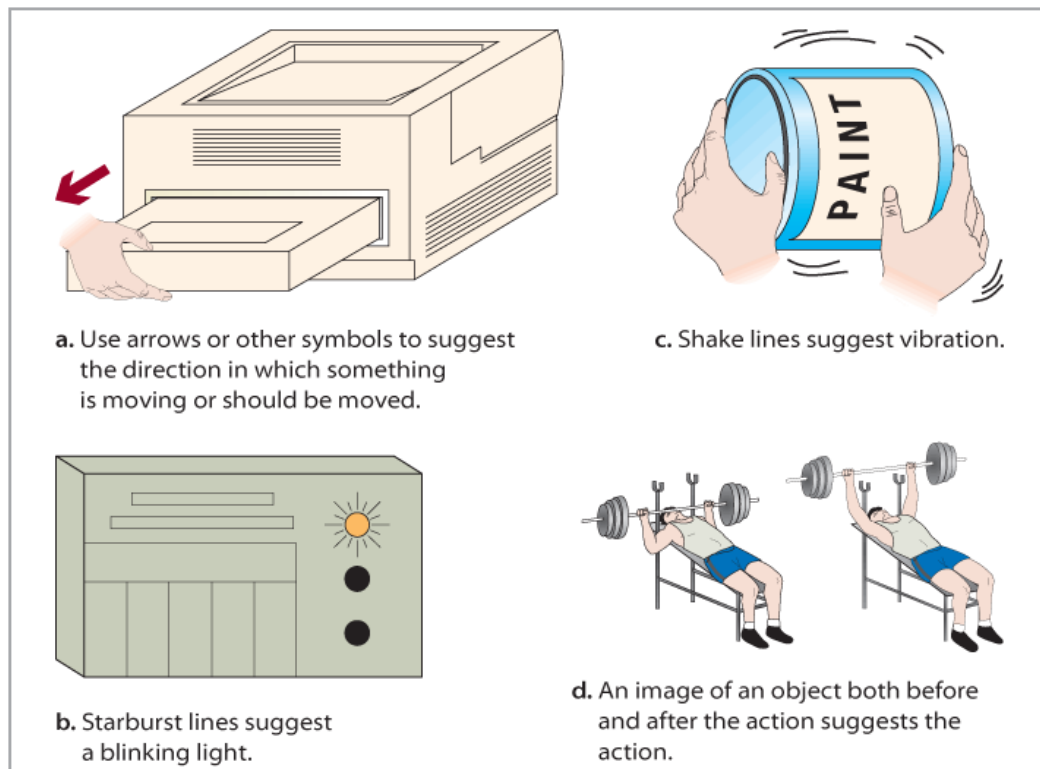


Figure 12.24
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.24 Showing Action or Motion

ILLUSTRATING VISUAL AND SPATIAL CHARACTERISTICS

To illustrate visual and spatial characteristics, use photographs, screen shots, line drawings, and maps.

Photographs *Photographs* are unmatched for reproducing visual detail. Sometimes, however, a photograph can provide too much information. In a sales brochure for an automobile, a glossy photograph of the dashboard might be very effective. But in an owner's manual, if you want to show how to use the trip odometer, use a diagram that focuses on that one item.



For a tutorial on photo editing, see the additional resources in LaunchPad.

Sometimes a photograph can provide too little information. The item you want to highlight might be located inside the mechanism or obscured by another component.

GUIDELINES: Presenting Photographs Effectively

Follow these five suggestions to make sure your photographs are clear, honest, and easy to understand.

- ▶ **Eliminate extraneous background clutter that can distract readers.** Crop the photograph to delete unnecessary detail. [Figure 12.25](#) (on [page 328](#)) shows examples of cropped and uncropped photographs.
- ▶ **Do not electronically manipulate the photograph.** There is nothing unethical about removing blemishes or cropping a digital photograph. However, manipulating a photograph — for example, enlarging the size of the monitor that comes with a computer system — *is* unethical.
- ▶ **Help readers understand the perspective.** Most objects in magazines and journals are photographed at an angle to show the object's depth as well as its height and width.
- ▶ **If appropriate, include some common object, such as a coin or a ruler, in the photograph to give readers a sense of scale.**
- ▶ **If appropriate, label components or important features.**



Figure 12.25
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Ken Wiedemann/Getty Images

FIGURE 12.25 Cropping a Photograph

Sometimes, writers and designers crop photographs to save space. Ideally, you should crop a photo because it helps you make your point. If you want to show how vulnerable to natural forces the structure in the photograph is, the left-hand version is better because it emphasizes the vastness of the sea. But if you want to discuss the ways the structure has been designed and built to resist natural forces, the right-hand version is better.

Screen Shots *Screen shots* — images of what appears on a computer monitor or some other screen — are often used in manuals to show users what the screen will look like as they perform tasks with the device. Readers who see that the screen shot accurately portrays what appears on their own devices are reassured and therefore better able to concentrate on the task they are trying to perform. [Figure 12.26](#) (on [page 328](#)) is an example of how screen shots are used.

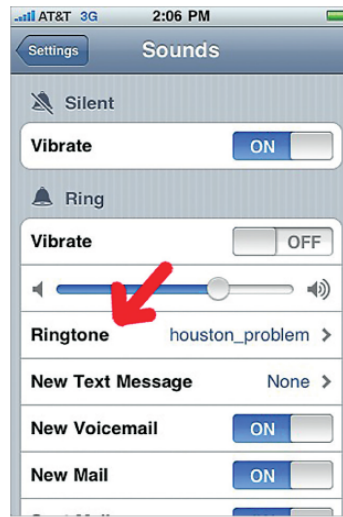


Figure 12.26
 Markel/Selber, *Technical Communication*, 12e,
 © 2018 Bedford/St. Martin's
 Information from NASA, 2013:
http://www.nasa.gov/connect/sounds/iphone_install_directions.html.

FIGURE 12.26 Screen Shot

This screen shot, from a user guide on NASA's website, shows users how to select a ringtone.

TECH TIP

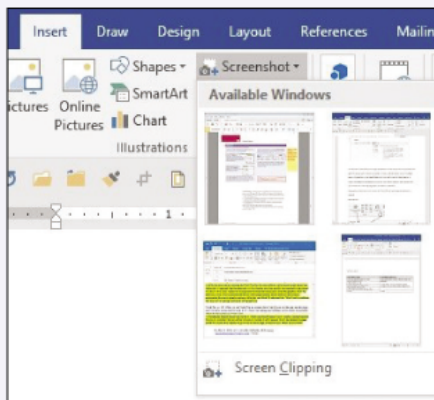
Why To Create and Insert Screen Shots

You may find that you need to share an image of your computer screen with an instructor, a colleague, or a tech-support worker. To show your reader what appears in a window on your monitor, you can create a screen shot by using a program such as Microsoft Word or simply by using your Windows or Mac operating system. If you plan to create many screen shots or if you want more sophisticated functionality, including video capture, search the Internet for "screen capture apps" such as TechSmith's Snagit.

How To Create and Insert Screen Shots

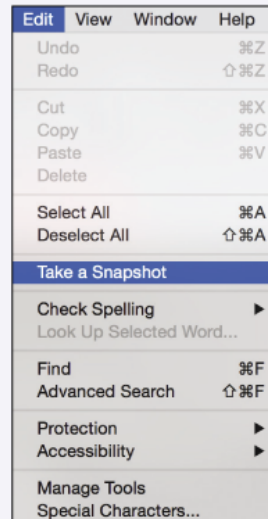
On Windows computers, press the **Print Screen** or **PrtScn** key on your keyboard to capture the entire screen, or **Alt + Print Screen** to capture only the active window. The screen shot will automatically be saved on your clipboard and can be inserted into a document using the **Paste** (or **Ctrl + V**) command. On Mac computers, press **Cmd + Shift + 3** to capture the entire screen, or **Cmd + Shift + 4** to define a screen selection to capture using your cursor. You can also use Microsoft Word and Adobe Acrobat to capture screen shots and then modify them by cropping or resizing.

Microsoft Word



From Word's **Insert** tab, select **Screenshot** to see a small version of each window you have open on your desktop. Click on the screen you want to show your readers, and Word will insert the picture into your document. To define your own screen selection, select **Screen Clipping** and use your cursor to select the portion of your screen you want to capture. To modify a screen shot, select it and use the **Format** tab tools as you would for any image.

Adobe Acrobat Reader



In Adobe Acrobat Reader, from the **Edit** menu, select **Take a Snapshot** and then use your cursor to select the portion of the screen you want to capture. The selection will automatically be saved to your clipboard. To select the entire page, simply click on the screen without dragging the mouse.

Line Drawings *Line drawings* are simplified visual representations of objects. Line drawings offer three possible advantages over photographs:

- Line drawings can focus readers' attention on desired information better than a photograph can.
- Line drawings can highlight information that might be obscured by bad lighting or a bad angle in a photograph.
- Line drawings are sometimes easier for readers to understand than photographs are.

[Figure 12.27](#) shows the effectiveness of line drawings.

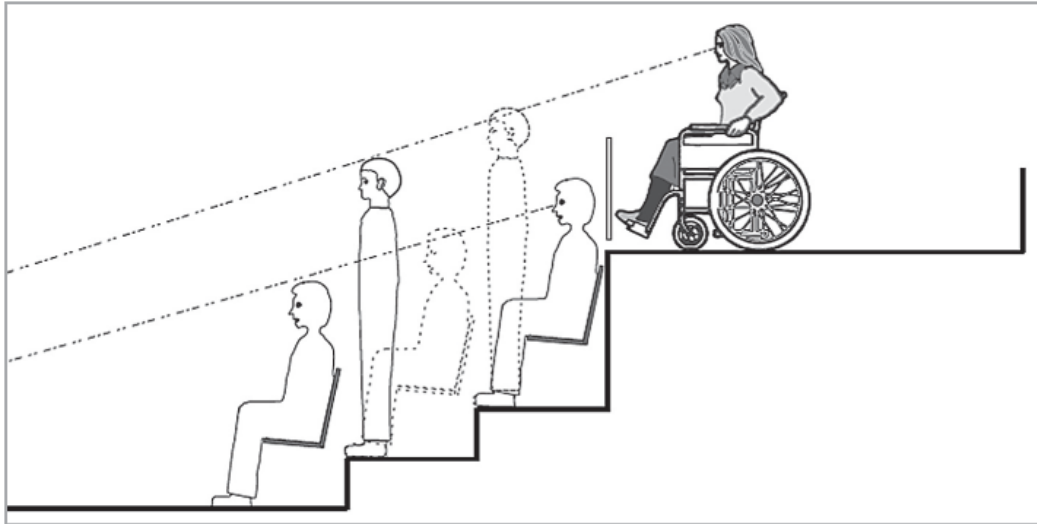


Figure 12.27
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's
Information from U.S. Department of Justice, 2010: www.ada.gov/stadium.pdf.

FIGURE 12.27 Line Drawing

This drawing, which accompanies a manual about the Americans with Disabilities Act, illustrates the idea that “wheelchair seating locations must provide lines of sight comparable to those provided to other spectators.” A photograph could not show this concept as clearly as this drawing does.

You have probably seen the three variations on the basic line drawing shown in [Figure 12.28](#).

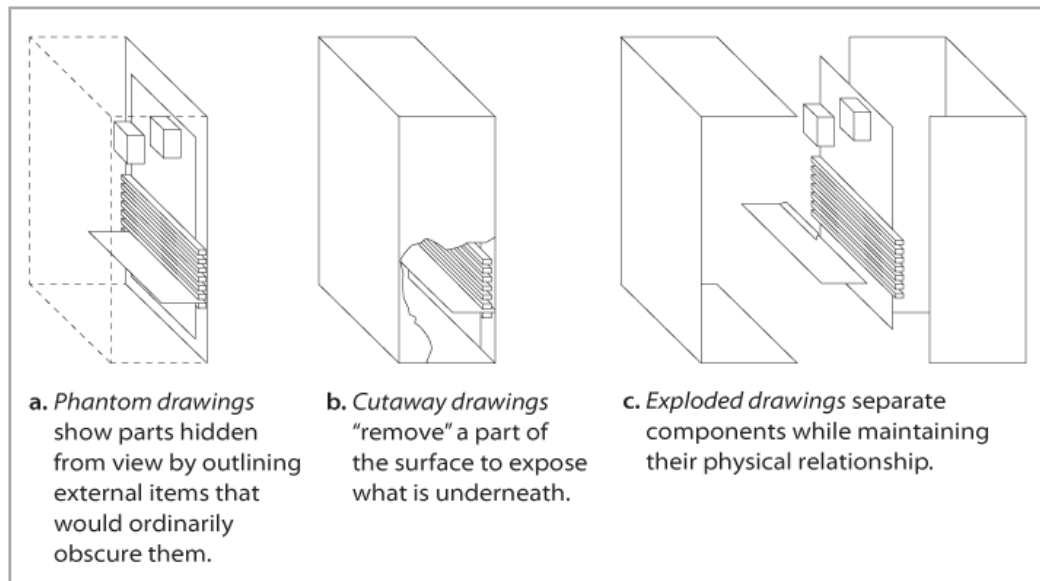


Figure 12.28
Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.28 Phantom, Cutaway, and Exploded Views

Maps Maps are readily available as clip art that can be modified with a graphics program. [Figure 12.29](#) shows a map derived from clip art.

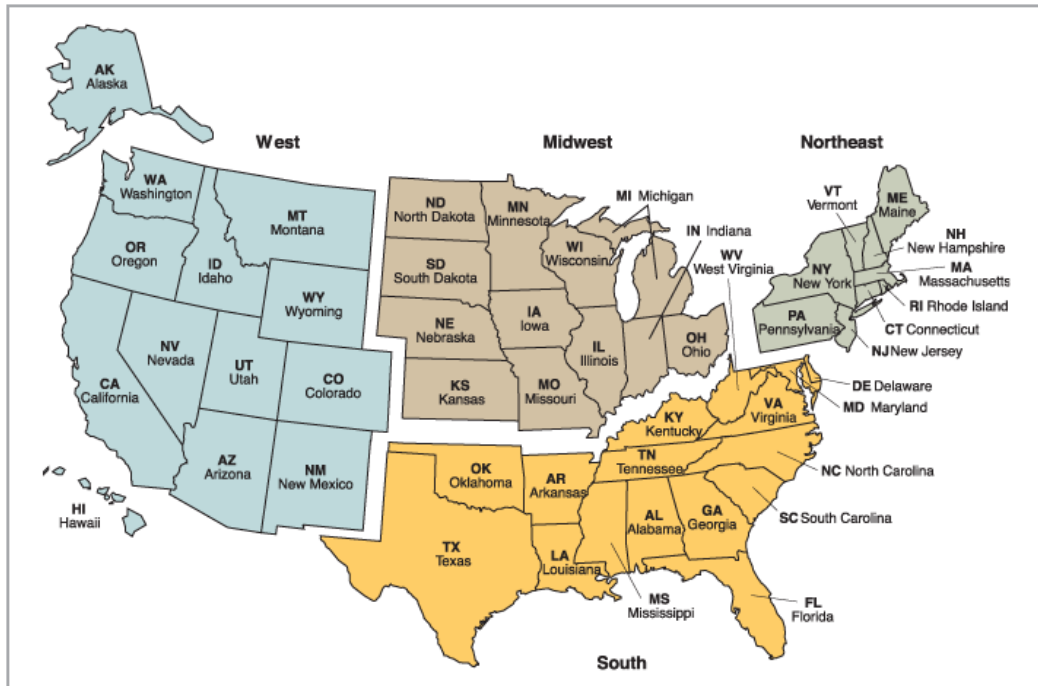


Figure 12.29

Markel/Selber, *Technical Communication*, 12e, © 2018 Bedford/St. Martin's

FIGURE 12.29 Map

Include a scale and a legend if the map is one that is not thoroughly familiar to your readers. Also, use conventional colors, such as blue for water.

Creating Effective Graphics for Multicultural Readers

Whether you are writing for people within your organization or outside it, consider the needs of readers whose first language is different from your own. Like words, graphics have cultural meanings. If you are unaware of these meanings, you could communicate something very different from what you intend. The following guidelines are based on William Horton's article "The Almost Universal Language: Graphics for International Documents" (1993).

- **Be aware that reading patterns differ.** In some countries, people read from right to left or from top to bottom. In some cultures, direction signifies value: the right-hand side is superior to the left, or the reverse. You need to think about how to sequence graphics that show action or where to put "before" and "after" graphics. If you want to show a direction, as in an informal flowchart, consider using arrows to indicate how to read the chart.
- **Be aware of varying cultural attitudes toward giving instruction.** Instructions for products made in Japan are highly polite and deferential: "Please attach the cable at this time." Some cultures favor spelling out general principles but leaving the reader to supply the details. To people in these cultures, instructions containing a detailed close-up of how to carry out a task might appear insulting.
- **Deemphasize trivial details.** Because common objects, such as plugs on the ends of power cords, come in different shapes around the world, draw them to look generic rather than specific to one country.
- **Avoid culture-specific language, symbols, and references.** Don't use a picture of a mouse (the furry rodent) to symbolize a computer mouse because the device is not known by that name everywhere. Avoid the casual use of national symbols (such as the maple leaf or national flags); any error in a detail might offend your readers. Use colors carefully: red means danger to most people from Western cultures, but it is a celebratory color to the Chinese.
- **Portray people very carefully.** Every aspect of a person's appearance, from clothing to hairstyle to physical features, is culture- or race-specific. A photograph of a woman in casual Western attire seated at a workstation would be ineffective in an Islamic culture where only a woman's hands and eyes may be shown. [Horton \(1993\)](#) recommends using stick figures or silhouettes that do not suggest any one culture, race, or sex.
- **Be particularly careful in portraying hand gestures.** Many Western hand gestures, such as the "okay" sign, are considered obscene in other cultures, and some people consider long red fingernails inappropriate. Use hands in graphics only when necessary — for example, to illustrate carrying out a task — and obscure the person's sex and race.

Cultural differences are many and subtle. Learn as much as possible about your readers and about their culture and outlook, and have your graphics reviewed by a native of the culture.

WRITER'S CHECKLIST

- ☐ Does the graphic have a purpose? ([p. 294](#))
- ☐ Is the graphic simple and uncluttered? ([p. 294](#))
- ☐ Does the graphic present a manageable amount of information? ([p. 294](#))
- ☐ Does the graphic meet readers' format expectations? ([p. 294](#))
- ☐ Is the graphic clearly labeled? ([p. 294](#))
- ☐ Is the graphic honest? ([p. 295](#))
- ☐ Does the graphic appear in a logical location in the document? ([p. 295](#))
- ☐ Is the graphic introduced clearly in the text? ([p. 295](#))
- ☐ Is the graphic explained in the text? ([p. 295](#))
- ☐ Is the graphic clearly visible in the text? ([p. 296](#))
- ☐ Is the graphic easily accessible to readers? ([p. 296](#))
- ☐ If you want to use an existing graphic, do you have the legal right to do so? ([p. 298](#)) If so, have you cited its source appropriately? ([p. 300](#))
- ☐ Is the graphic inoffensive to your readers? ([p. 331](#))

EXERCISES

For more about memos, see Ch. 14, p. 376.

- Find out from the admissions department at your college or university the number of students enrolled from the different states or from the different counties in your state. Present this information in four different kinds of graphics:
 - map
 - table
 - bar graph
 - pie chart

In three or four paragraphs, explain why each graphic is appropriate for a particular audience and purpose and how each emphasizes different aspects of the information.
- Design a flowchart for a process you are familiar with, such as applying for a summer job, studying for a test, preparing a paper, or performing some task at work. Your audience is someone who will be carrying out the process.
- The following table provides statistics on federal research and development expenditures ([U.S. Census Bureau, 2013](#), Table 815). Study the table, and then perform the following tasks:
 - Create two different graphics, each of which compares federal R&D funding in 2011 and 2012.
 - Create two different graphics, each of which compares defense and nondefense R&D funding in either 2011 or 2012.

Table 815. Federal Research and Development (R&D) by Federal Agency: Fiscal Year 2011 and 2012

[In millions of dollars (144,368 represents \$144,368,000,000). For fiscal years ending September 30. R&D refers to actual research and development activities as well as R&D facilities. R&D facilities (also known as R&D plants) includes construction, repair, or alteration of physical plant used in the conduct of R&D. Based on Office of Management and Budget data]

Federal agency	2011	2012	Federal agency	2011	2012
Total research and development.....	144,368	140,565			
Defense R&D.....	83,193	78,745	Department of Veterans Affairs.....	1,160	1,164
Nondefense R&D.....	61,176	61,820	Department of Homeland Security.....	760	617
Department of Defense.....	79,112	74,464	Department of Transportation.....	954	945
Science and technology.....	12,751	13,530	Department of Interior.....	757	796
All other Department of Defense R&D.....	66,361	60,935	U.S. Geological Survey.....	640	675
Health and Human Services.....	31,183	31,143	Environmental Protection Agency.....	582	568
National Institute of Health.....	29,831	30,046	Department of Education.....	362	392
All other Health and Human Services R&D.....	1,352	1,097	Smithsonian.....	259	243
Department of Energy.....	10,673	11,019	International Assistance Programs.....	121	121
Atomic Energy Defense.....	4,081	4,281	Department of Housing and Urban Development.....	79	57
Office of Science.....	4,461	4,463	Department of State.....	75	75
Energy R&D.....	2,131	2,275	Nuclear Regulatory Commission.....	99	83
NASA.....	9,099	9,399	Department of Justice.....	109	92
National Science Foundation.....	5,494	5,614	Social Security Administration.....	42	8
Department of Agriculture.....	2,135	2,331	U.S. Postal Service.....	14	14
Department of Commerce.....	1,217	1,263	Tennessee Valley Authority.....	18	15
National Oceanic and Atmospheric Administration.....	629	581	Army Corps of Engineers.....	11	11
National Institute of Standards and Technology.....	532	555	Telecommunications Development Agency.....	7	4
			Department of Labor.....	4	4

Source: American Association for the Advancement of Science (AAAS), *AAAS Report XXXVI: Research and Development FY2013*, annual (copyright). See also <<http://www.aaas.org/spp/rd/rdreport2013/>>.

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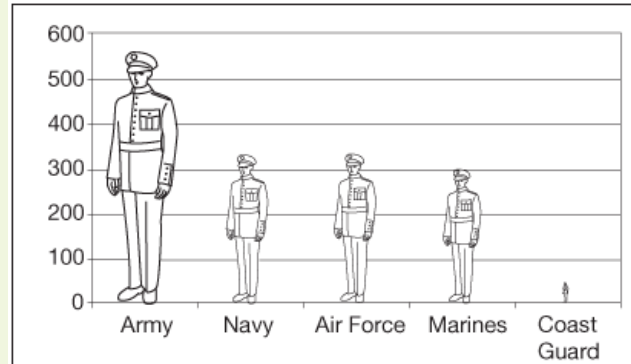
American Association for the Advancement of Science (AAAS). AAAS Report XXXVI. Research and Development FY 2013. Reprinted with permission from AAAS.

- For each of the following four graphics, write a paragraph evaluating its effectiveness and describing how you would revise it.
 - Majors

	2015	2016	2017
Civil Engineering	236	231	253
Chemical Engineering	126	134	142
Comparative Literature	97	86	74
Electrical Engineering	317	326	401
English	714	623	592

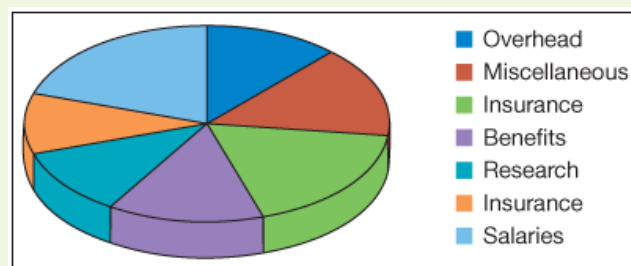
Fine Arts	112	96	72
Foreign Languages	608	584	566
Materials Engineering	213	227	241
Mechanical Engineering	196	203	201
Other	46	42	51
Philosophy	211	142	151
Religion	86	91	72

b. Number of Members of the U.S. Armed Forces in 2012 (in Thousands)



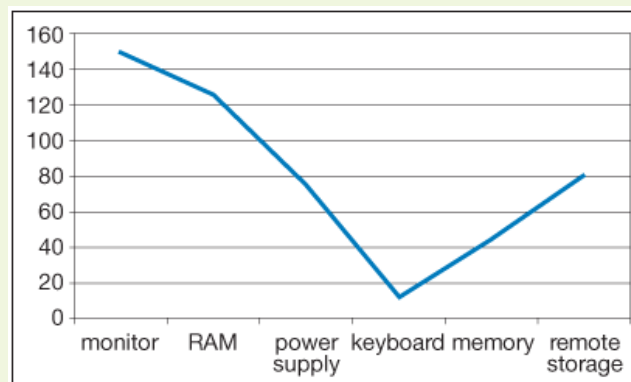
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c. Expenses at Hillway Corporation



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d. Costs of the Components of a PC

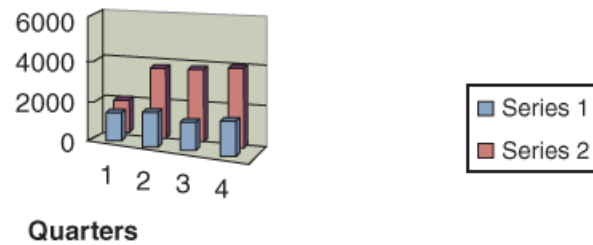


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5. The following three graphs illustrate the sales of two products — Series 1 and Series 2 — for each quarter of 2017. Which is the most effective in conveying the information? Which is the least effective? What additional information would make the most effective graph better?

a.

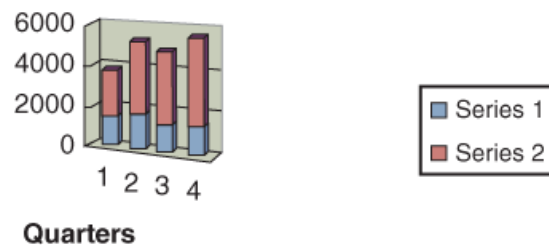
2017 Sales of Series 1 and 2, by Quarters



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b.

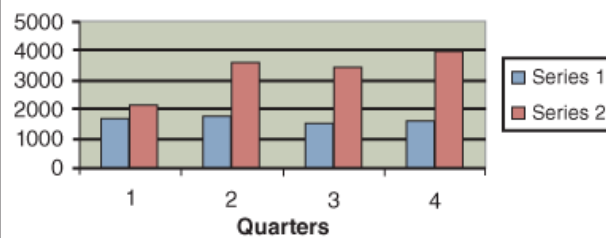
2017 Sales of Series 1 and 2, by Quarters



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c.

2017 Sales of Series 1 and 2, by Quarters



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6. Using a search engine, search for "infographics college tuition." Find two infographics that present information on similar topics, such as tuition costs for public and private colleges and universities, average tuition costs in each of the fifty states, or the relationship between tuition costs and future earnings potential. Write a 1,000-word memo to your instructor in which you identify the audience and purpose of the infographics and compare and contrast them using such criteria as audience, purpose, clarity, visual appeal, use of different types of graphics, and citation of the data sources. Which infographic do you think is better? Why?
7. Locate a graphic on the web that you consider inappropriate for an international audience because it might be offensive or unclear to readers in some cultures. Imagine an intended audience for the graphic, such as people from the Middle East, and write a brief statement explaining the potential problem. Finally, revise the graphic so that it would be appropriate for its intended audience.

CASE 12: Creating Appropriate Graphics To Accompany a Report

Following a series of texting-related driving accidents, a representative in your state legislature has decided to introduce legislation restricting the use of cell phones while driving. As an assistant to the state's insurance commissioner, you have been asked to collect data on how cell-phone use affects driving. The representative hopes to use these data to make his case for the legislation. When you present your findings to your supervisor, she asks that you pare them down to the facts most relevant to the representative. She also asks that you consider presenting some of the data graphically. To get to work improving your research, go to LaunchPad.



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